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FERNALD (H. T.) & SHEPARD (H. H.). **Applied Entomology. An Introductory Textbook of Insects in their Relations to Man.**—4th edn. (revd.), Demy 8vo, ix+400 pp., 383 figs. New York & London, McGraw-Hill Book Co., Inc., 1942. Price 24*s.* 6*d.*

The general arrangement of the subject-matter in this edition is the same as in the previous three [*R.A.E.*, A **10** 82; **14** 359; **23** 480], but the information on insecticides has been brought up to date and the chapters dealing with them and with general control methods and the economic importance of insects have been rewritten. There are some alterations in the text and sequence of the chapters on the individual insect Orders and the one on other injurious animals, chiefly Arthropods, with which entomologists may be concerned. They are illustrated by reference to species of importance in the United States as pests of agricultural crops or as medical or veterinary pests, for most of which control measures are given.

CAFFREY (D. J.) & BAKER (W. A.). **The European Corn Borer: its present Status and Methods of Control.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1548 (revd.), 42 pp., 37 figs. Washington, D.C., 1941. [Recd. 1943.]

In this bulletin, which is a revision of a previous one [*R.A.E.*, A **24** 271], short accounts are given of the spread of *Pyrausta nubilalis*, Hb., on maize in the United States and Canada, its present distribution in the United States, which is shown on a map, its bionomics and the injury that it causes, together with notes on the losses due to it in the Lake States, where there is one generation a year, in the eastern States, where the multiple-generation strain predominates, and in other countries. In the section on natural enemies, of which only some introduced parasites are of any value, it is stated that though the establishment of several species has resulted in fairly high rates of parasitism [**31** 288–289], no immediate important results can be expected from them and the use of direct control methods is therefore recommended. These include the destruction of infested plants and crop remnants before adult emergence by feeding to livestock, deep ploughing or burning. All maize should be cut as low as possible, and high-cut stubble destroyed. Clean cultivation should also be practised in gardens in which sweet maize is grown, and in the eastern States, where the larvae also attack many vegetables, field crops, flowers and large-stemmed weeds and grasses, these plants should be included in the cleaning operations. Sprays of derris, cubé, nicotine tannate or phenothiazine are effective, though expensive, and some control may be given by trap crops and late planting, though the smaller number of larvae that occur on late-planted maize is largely offset by the greater amount of damage caused per larva.

Brief notes are appended on the appearance and habits of larvae of other moths that also infest maize and may be confused with *P. nubilalis*.

MACKIE (D. B.), STEINWEDEN (J. B.) & CARTER (W. B.). **The present Status of the European Earwig in California and its Fumigation in balled, canned or potted Nursery Stock.**—*Bull. Calif. Dep. Agric.* **31** no. 3 pp. 110–116, 1 fig., 5 refs. Sacramento, Calif., 1942.

Forficula auricularia, L., was first found in the San Francisco Bay area in 1923, and is now distributed generally there, though it is increasing very slowly. It has not become established in southern California, and as it is readily transported by man, owing to its habit of hiding during the day in any available shelter, such as packages and bundles, the authors consider that it has probably reached the limits of its economic distribution. From studies and observations

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extending over 14 years, they conclude that it is a household nuisance rather than a nursery or garden pest and is more likely to be carried in luggage or merchandise than in nursery stock. It is comparatively easily controlled with a poison bait [*cf. R.A.E.*, A **30** 275], but apparently cannot be prevented from spreading if it becomes established in a favourable locality.

Frequent rejections of nursery stock because earwigs were found under the burlap coverings of the balls, in packing material or in cracks in the soil have caused considerable losses, and a series of tests on atmospheric fumigation with methyl bromide showed that all stages were readily killed by this treatment, even when buried as deeply as four inches in soil. Complete mortality of the active stages and of the eggs was obtained with a dosage of 2 lb. per 1,000 cu. ft. for 2 hours at 57 and 70°F., respectively, and 85 per cent. relative humidity. Tests in which batches of eggs were kept with or without the attendant female, to determine whether fumigation of egg masses was successful because the death of the mother deprived them of proper attention, indicated that incubation care up to three days before hatching prevents destruction of the eggs by mould.

In view of the results obtained, the authors recommend that nursery stock should be fumigated with 2 or 2½ lb. methyl bromide per 1,000 cu. ft. for two hours at minimum temperatures of 70 or 60°F., respectively; higher dosages should be avoided if conifers, indoor decorative plants or other plants sensitive to methyl bromide are involved.

ARMITAGE (H. M.). **The Place of Methyl-bromide in the Disinfection of infested Orchid Plants.**—*Bull. Calif. Dep. Agric.* **31** no. 3 pp. 134–140, 1 fig. Sacramento, Calif., 1942.

The author discusses the danger of introducing new insect pests of orchids into California, particularly with plants that are transported from their native habitat, gives instances of potentially serious ones intercepted at San Francisco and describes methods that have been used for disinfesting the plants. Fumigation with hydrocyanic acid was originally the standard treatment, but causes so much damage to the plants that methyl bromide is now generally employed in California. It is best applied in a damp atmosphere and the recommended dosages per 1,000 cu. ft. for dormant plants are 3 lb. for 1½ hours at 80°F., 2 hours at 70°, 2½ hours at 60° or 3 hours at 50° for species of *Cattleya* received direct from tropical jungles, and 3 lb. for 2 hours at 70°, 2½ hours at 60°, or 3 hours at 50°F., or 2 lb. for 1½ hours at 90° or 2 hours at 80°F. for most other genera, fumigation being carried out at atmospheric pressure against insects that feed externally or under a vacuum of 15 ins., maintained for the full period of exposure, against those that are within the tissue of the plant. Fumigation at temperatures below 50°F. is not recommended. Methyl bromide causes more than superficial injury to species of *Cypripedium* and *Cymbidium*, and should not be used at such high dosages when these genera are concerned; 1½ lb. per 1,000 cu. ft. for 2 hours at 70–75°F. was found to be completely lethal to several orchid-infesting Coccids without injuring the plants. The Cecidiomyiids that form root galls are the only insects intercepted that did not respond to treatment with reasonable dosages of methyl bromide; the only known method of eliminating these is the removal of infested roots. The precautions taken during fumigation are described in some detail.

Experimental fumigation of orchid houses with methyl bromide for the control of *Diorymerellus laevimargo*, Champ., which has become established in some houses in the State, gave satisfactory control of the beetle, but caused injury to flowers and flower spikes that was apparently proportional to the moisture in the plants or growing media. Such fumigation should therefore be carried out only when no blooms or buds are present and after drying the plants as much as is possible.

Spraying and Dusting Potatoes.—*Bull. N. Dak. agric. Exp. Sta.* no. 319, 19 pp., 9 figs., 9 refs. Fargo, N. Dak., 1943.

This bulletin is in two parts ; the first (pp. 3–13) is by J. A. Munro and H. S. Telford and deals with the insect pests of potato in North Dakota and their control, and the second deals with diseases, principally those caused by fungi. A spraying and dusting schedule for the control of both is appended. The principal insect pests are *Epitrix cucumeris*, Harr., injury by which is confined to the feeding of the adults, damage to the roots and tubers by the larvae being rare, *Leptinotarsa decemlineata*, Say, which has one complete and one partial generation each year, and *Empoasca fabae*, Harr., which is scarce in early summer, but becomes abundant in August. Adults of this Jassid failed to survive the winter in field tests, and it is thought that new populations are carried by wind from the south each spring. It can be controlled by sprays or dusts containing copper compounds, and calcium arsenate, at the rate of 4 lb. per 100 U.S. gals. in the sprays or 20 per cent. in the dusts, should be added to the first and second applications to control the two beetles. Applications should begin at the first sign of insect injury, usually about the first week in July, and should be continued at intervals of 10–14 days as long as necessary.

Grasshoppers and Meloids [*cf. R.A.E.*, A **30** 599] are occasionally very injurious. The grasshoppers are best controlled by poison baits, and the Meloids, of which the chief species are *Macrobasis unicolor*, Kby., and the spotted and black blister beetles [*Epicauta maculata*, Say, and *E. pennsylvanica*, Deg.], by prompt applications of a dust of barium fluosilicate and wheat flour (1 : 3) at the rate of about 20 lb. per acre. Aphids are usually scarce, but are of importance as vectors of virus diseases if they become abundant and should be controlled if necessary by a 3 per cent. nicotine dust or by the inclusion of nicotine sulphate (1 : 800) in a spray of Bordeaux mixture. The tarnished plant bug [*Lygus oblineatus*, Say] and allied species sometimes destroy the growing points of the shoots, but no satisfactory control measure is known. The potato Psyllid [*Paratrioza cockerelli*, Šulc] is of only slight importance in North Dakota, and control measures are rarely necessary.

During extremely hot weather in July 1936, when maximum temperatures of 105–121°F. were recorded, larvae of *Leptinotarsa decemlineata* left the plants in numbers, but were quickly killed on coming into contact with the surface of the soil, which was considerably hotter than the surrounding air. Natural enemies of this beetle in North Dakota include the Pentatomid, *Perilloides* (*Perillus*) *bioculatus*, F., which preys upon the eggs and larvae, and the parasite, *Doryphorophaga doryphorae*, Ril., which has been present since 1939 in most potato-growing areas in the State. *Nabis ferus*, L., which is predacious on *Empoasca fabae*, is also common.

Either dusts or sprays give satisfactory control of leaf-eating insects on potato, and three applications are required against the commonest. A spray of Bordeaux mixture and calcium arsenate gave increased yields [*cf.* **27** 70], and tests of dusts containing various copper compounds showed that all are effective. The rate at which copper compounds should be applied depends on their content of metallic copper, since 2–3 lb. of the latter is required per acre at each application. A suitable formula for the Bordeaux mixture is 10 lb. copper sulphate and 5 lb. lime per 100 U.S. gals. as this quantity applies about 2½ lb. copper. The addition to copper dust mixtures of pyrethrum to give 0·08 per cent. pyrethrin content resulted in a further increased yield.

Elmore (J. C.). **The Pepper Weevil.**—*Leafl. U.S. Dep. Agric.* no. 226, 8 pp., 6 figs. [Washington, D.C.] 1942.

An account is given of the life-history of *Anthonomus eugenii*, Cano, which is the most important insect pest of peppers [*Capsicum*] in California, Arizona,

New Mexico, Texas and Florida, and causes serious losses, amounting to 50 per cent. of the crop in some years, unless controlled [*cf. R.A.E.*, A **23** 109]. The adult is less injurious than the larva, which feeds on a single blossom bud or pod, causing it to drop or to be malformed or discoloured. The life-cycle may last 5–6 weeks in cool weather and only 2–3 weeks in warm weather, when the egg, larval and pupal stages are completed in 3–4, 8–10 and 4–6 days, respectively. In California, some weevils migrate to wild nightshade (*Solanum* spp.) in autumn, while others remain on old pepper plants, and in spring one or two generations may develop in the berries of the nightshade or in the blossom buds of the old pepper plants before the weevils fly to the new fields of pepper in June, as the plants begin to set blossom buds. They sometimes live on egg-plant [*Solanum melongena*] and occasionally on potato foliage in the absence of pepper or nightshade, but do not survive for long on other plants.

The most satisfactory insecticide is a dust of cryolite containing approximately 50 per cent. sodium fluoaluminate, applied at intervals of 5–7 days [*cf.* **31** 104], the formula recommended being 59 lb. cryolite (85 per cent. sodium fluoaluminate) and 41 lb. talc. If the use of this dust results in injurious infestations of Aphids [*Myzus persicae*, Sulz.], a dust mixture containing 3 per cent. nicotine should be applied. Cultural measures of control include burying or burning infested pods as soon as they fall, destroying old pepper plants by thorough disking or ploughing as soon as the crop is harvested, and destroying nightshade growing near the old pepper fields by 15th January in California and not later than winter or early spring in other areas.

YOUNG (B.). **White Flies attacking *Citrus* in Szechwan.**—*Sinensia* **13** pp. 95–101, 13 figs. Peipah, 1942.

Descriptions are given of the following Aleurodids found on *Citrus* in Szechwan: *Dialeurodes citri*, Ril. & How., *D. citricola*, sp. n., *Bemisia giffardi*, Kotinsky, with subsp. *bispina*, n., *Aleurolobus szechwanensis*, sp. n., *Aleurocanthus cheni*, sp. n., and two unnamed species belonging to the genera *Aleurotuberculatus* and *Aleurotrachelus*.

KAISER (W.). **Zur Bekämpfung des Apfelblütenstechers.** [The Control of the Apple Blossom Weevil.]—*Kranke Pflanze* **20** pt. 3–4 pp. 22–28. Dresden, 1943.

Anthonomus pomorum, L., causes injury of importance in Germany in seasons when it is abundant and apple blossoms are relatively scarce. It is best controlled by measures directed against the adults after they have left their winter quarters and before they have oviposited on the apple trees. Migration to the trees occurs mostly when the maximum day temperature reaches 10–11°C. [50–51·8°F.] and the average 7–8°C. [44·6–46·4°F.]. The weevils begin to fly at 14–15°C. [57·2–59°F.], and are most active in windless weather and positions sheltered by forests. The course of migration can be followed by counting the weevils that shelter during the night in corrugated paper trap-bands when the temperature is low and by jarring the trees in warmer weather, and sprays can be correctly timed by these means. In tests with various proprietary insecticides in 1941 and 1942, the best results were given by preparations containing dinitro-ortho-cresol. These should be applied at a rate to give 0·5 per cent. dinitro-cresol in the spray and do not harm dormant trees. The weevils are killed not only by immediate contact with the spray but also by the deposit on the twigs and branches.

SCHMIDT (H. W.). **Die Bekämpfung des Rübenaaskäfers.** [The Control of *Silpha undata* and *S. opaca*.]—*Kranke Pflanze* **20** pt. 3–4 pp. 34–35. Dresden, 1943.

Beet in Germany is attacked by *Silpha* (*Blitophaga*) *undata*, Müll., and *S.* (*B.*) *opaca*, L., which have very similar life-histories. In mid-April, the adults leave their winter quarters in the ground and under stones, litter or moss, and attack young grasses and cereals, to which they sometimes cause considerable harm. They later migrate to chenopodiaceous weeds and, when the tissues of these harden, they attack beet and sometimes rape, carrots and potato. Pairing occurs from April to July, and the female lays about 120 eggs in the surface layer of the soil. The larvae, which are favoured by dry and not too hot weather, hatch in 5–9 days and live on chenopodiaceous weeds, grasses or beet, sometimes destroying whole fields of sugar-beet. After feeding for 11–15 days, they enter the ground, rest for 2–7 days and then pupate. The adults emerge 7–9 days later, feed for some weeks and then seek winter quarters. The adults are best controlled in May and the larvae in August. The measures recommended are intensive hoeing, rolling, which kills many adults, and the use of arsenical dusts, which are very effective but are complicated to apply, and of poison baits of bran and sugar with Paris green or sodium fluosilicate, which also control other pests.

ZIELKE (O.). **Ueber die Eschenwollschildlaus, *Fonscolombea fraxini* (Kalt.) Ckll. (Hem. Cocc.), und die standörtlichen Befallsverhältnisse bei der Esche, *Fraxinus excelsior* L.** [On the Ash Scale, *Fonscolombia fraxini*, and the local Conditions governing Infestation of the Ash, *Fraxinus excelsior*.]—*Arb. biol. Reichsanst.* **23** pt. 3 pp. 293–386, 10 pls., 2 maps, 1 graph, 35 figs., many refs. Berlin, 1942.

Numerous colonies of *Fonscolombia fraxini*, Kalt., occur regularly on ash trees in the streets of Berlin, but trees in the outer districts of the city are often uninfested and show a difference in mode of growth. The author has investigated the causes of this difference in infestation and also made observations on forest ash trees. He gives a detailed account of the nomenclature, synonymy, distribution, morphology, anatomy, biology and natural enemies of *F. fraxini*, and of the ecology in forests and in Berlin of the common ash (*Fraxinus excelsior*), which is its chief food-plant and the only one heavily infested by it, and concludes that it is a secondary pest, attacking only weak trees, and that heavy infestations indicate that the soil and environment are unfavourable.

SCHNEIDER-ORELLI (O.) & BRAUN (W.). **Die Grenzverschiebungen zwischen Berner- und Urnerflugjahrsgebieten des Maikäfers in der Umgebung von Zürich.** [The Shift, in the Neighbourhood of Zürich, of the Boundaries between the Berne and Uri Flight Year Regions of *Melolontha melolontha*.]—*Ber. schweiz. bot. Ges.* **53** (A) pp. 500–516, 5 figs., 4 refs. Berne, 1943.

Melolontha melolontha, L., has a three-year life-cycle in Switzerland, but various strains of the beetle have their main flights in different years. In the district of Zürich there are two strains, which have their main flights in years that leave remainders of 1 and 2, respectively, when divided by 3, the so-called Berne and Uri flight-years. Records since 1843 show that beetles of the first group have spread from the extreme west of the district in an easterly direction and have now largely replaced those of the second, which were formerly dominant and now occur only in a restricted area to the north-east of the Greifensee. The situation in 1843, 1900 and 1942 is shown on maps. In a discussion of possible reasons for the change, it is pointed out that the prevailing wind is westerly in this region.

OSSIANNILSSON (F.). **Studier över de svenska potatisfältens insektfauna och dess betydelse för spridning av virussjukdomar. I. Hemiptera, förekomst och utbredning.** [Studies on the Insect Fauna of Swedish Potato Fields and its Importance for the Spread of Virus Diseases. I. Rhynchota, Occurrence and Distribution.]—*Medd. Växtskyddsanst.* no. 39, 72 pp., 18 figs., 53 refs. Stockholm, 1943. (With a Summary in German.)

In connection with current investigations in Sweden on virus diseases of potato, the author visited many central and southern potato-growing districts during the summers of 1941 and 1942 to ascertain what insects that might prove to be vectors occur on this crop and whether they are widely distributed. Samples were obtained by sweeping and by examining leaves collected at random in the fields, and the results as regards the Rhynchota are presented in this paper. Among the Aphids, *Macrosiphum solani*, Kalt. (*Aulacorthum pseudosolani*, Theo.), which had not previously been recorded from Sweden, and *Myzus* (*Myzodes*) *persicae*, Sulz., were the most widely distributed, but did not occur further north than 62° 32′ and 63° 15′ N. lat., respectively. Since peach, the winter food-plant of *M. persicae*, is uncommon in Sweden and occurs there only in the south, it must overwinter on some other plant. Other Aphids that were generally distributed were *Macrosiphum solanifolii*, Ashm. (*euphorbiae*, auct.), *Aphis* (*Doralis*) *rhamni*, Boy., and *A. gossypii*, Glov., which the author considers a synonym of *A.* (*D.*) *frangulae*, Koch. Among insects of other families, those taken most widely were the Psyllid, *Trioza nigricornis*, Först., the Jassids, *Cicadella atropunctata*, Goeze, *Empoasca pteridis*, Dahlb., and *E. flavescens*, F., and the Capsids, *Lygus pratensis*, L., *L. pubescens*, Reut., and *Plagiognathus chrysanthemi*, Wolff. For all these species the author gives descriptions of the various stages, previous records from Sweden, lists and maps showing the localities in which he took them on potato and on other plants and notes from the literature on the life-history and ability or otherwise in other countries to transmit plant viruses. Keys to the five Aphids based on the viviparae are also included, together with brief notes on various other Aphids, Jassids and Heteroptera that were also taken on potato but were not common.

MATHLEIN (R.). **Undersökningar rörande förrådsskadedjur. III. Svartbruna mjölbaggen, *Tribolium destructor* Uytt. Ett nytt, ekonomiskt viktigt skadedjur.** [Investigations on Pests of stored Products. III. The Dark Brown Flour Beetle, *Aphanotus destructor*, a new economically important Pest.]—*Medd. Växtskyddsanst.* no. 41, 38 pp., 15 figs., 9 refs. Stockholm, 1943. (With a Summary in German, pp. 33–38.)

Aphanotus (*Tribolium*) *destructor*, Uytt., was first observed in Sweden in 1934 [*cf. R.A.E.*, A **25** 280] ; 50 cases of infestation by it have since been reported, and it is feared that it may have become widely distributed there. All stages are described, records of its occurrence elsewhere are briefly reviewed [*cf.* **27** 623, etc.], and an account is given of laboratory investigations on its bionomics begun in 1939.

The females oviposit on flour or other suitable substances or in packing materials such as bags, sacks and boxes ; the preoviposition period lasted three weeks at room temperature, 12 days at 26–28°C. [78·8–82·4°F.] and up to or more than four months at 12–16°C. [53·6–60·8°F.]. Pairing occurred several times during adult life, even as late as 18 months after emergence, but its repetition was not essential for normal production of fertile eggs. The numbers of eggs laid per female for pairs kept in dishes with a thin layer of a mixture of wheat and rye flour and 70–75 per cent. relative humidity ranged from 73 to 129 at 13–15°C. [55·4–59°F.], 585 to 883 at 14–21°C. [57·2–69·8°F.], 400 to 1,239 at 25–26°C. [77–78·8°F.], 236 to 526 at 28°C. [82·4°F.] and 0 to 80 at 30·5–31·5°C. [86·9–88·7°F.] ; none of those laid at the last temperature hatched.

The length of the oviposition period also varied considerably ; the maximum observed was 970 days at 14–21°C. The percentage of eggs that hatched was greatest (80) at 28°C. and was only 10 at 13·5–14°C. [56·3–57·2°F.] ; it did not vary with the age of the female. Examination of the figures showed that 50 per cent. of all the eggs were laid within 2·5–3·5 months of the beginning of oviposition and the rest during about a year. The duration of development varied inversely with the temperature and ranged from 39 days at 30·5–31·5C°. to 212 days at 15–17°C. [59–62·6°F.] ; it was 99 days at room temperature (19–20°C. [66·2–68°F.]), at which the egg, larval and pupal stages lasted 12, 70 and 17 days. The adults lived for long periods after reproduction had ceased ; one pair kept at an average of 15–17°C. in flour survived for about four years, or 16 months after the last eggs were laid.

This Tenebrionid is resistant to unfavourable conditions of humidity and nutrition but not to cold. Adults and half-grown larvae survived starvation for six weeks and newly hatched larvae for about a fortnight in a warm, dry room, and living larvae and adults were found in wheat with a moisture content of only 10·8 per cent. that had been kept under warm conditions for two years. Adults and larvae also survived for several months when allowed no food but the larval exuviae, and ultimately fed on the bodies of those that died. All the developmental stages died within 40 days at 3·5°C. [38·3°F.] and within 10 days at −2°C. [28·4°F.], and adults and larvae died in three days at −6°C. [21·2°F.]. In a test in which various stages of *A. destructor*, *Tribolium castaneum*, Hbst., *Calandra oryzae*, L., *C. granaria*, L., *Tenebrio molitor*, L., *Sitodrepa panicea*, L., and *Ephestia kuehniella*, Zell., were kept in a vessel containing wheat, oats, flour and pieces of bread in a cellar of which the temperature ranged from 0·5 to 5°C. [32·9–41°F.], the first three species had died out in a month, but the others still survived after nearly four months, when the observations were discontinued. When jars containing adults and larvae of *A. destructor* with grain and flour were placed beneath the surface of the grain and in various other positions in two granaries on 15th December 1938, examination on 31st January 1939 showed that all of them had died. The minimum temperatures recorded in the granaries during this period were −7 and −2°C. [19·4 and 28·4°F.], respectively. It appears therefore that in Sweden, *A. destructor* is unable to survive the winter in unwarmed premises.

Both adults and larvae are active and crawl through cracks in packing materials, floors and walls. The adults are winged but have not been observed to fly. In tests on the ability of larvae and adults to reach food, they penetrated paper bags but not bags of cotton material. Cereal products of all kinds are attacked [*cf.* **31** 371] and are favourable for larval development. No infestation of stored grain has been reported, and experiments showed that though unmilled wheat is attacked to some extent and some reproduction takes place in it, especially when it contains a high proportion of broken grains or its moisture content is high, the beetle is not likely to prove a serious pest of stored grain. No reproduction occurred in stored rye, barley or oats, and though the adults survived for long periods and laid eggs in ground rice and in seeds of clover and timothy grass [*Phleum pratense*], very few of the larvae completed their development. Both larvae and adults have been observed to feed on sweet almonds, and both survived in sugar for about three months ; peas were not attacked by any stage. Several cases have been reported of attack by adults and particularly larvae on furs and cloth, but experiments indicated that they cannot survive long on these materials and that such injury is usually caused by individuals seeking shelter for pupation, etc. The beetle spreads rapidly in houses and readily enters wardrobes and cupboards. Dead insects are also attacked, and development was completed on dead adults of *Ephestia kuehniella* ; injury may therefore be caused to insect and other collections. Insulation sheets and panels of wood fibre and cork, such as are used in modern house construction, also provide favoured sites for pupation and have been

considerably injured. In addition to the direct damage caused in all these instances, the beetle communicates a strong smell of lysol to substances with which it comes into contact, so that foodstuffs are rapidly rendered unusable.

The beetle is spread mainly with infested products, empty sacks, etc., so that storehouses and packing materials should be kept clean. The larvae and adults survived for only 15 minutes at 50°C. [122°F.] and the eggs for only 5 minutes, so that heating to a temperature of 60–70°C. [140–158°F.] for a couple of hours, to allow for penetration of the materials, will destroy infestations ; cereal products and other foodstuffs should be spread in a thin layer for treatment. During the winter, infestation can be controlled by exposure to cold. Household sprays of pyrethrum extract in mineral oil were effective against the larvae and adults, and a high-grade pyrethrum powder (Pyretin) was also satisfactory. Derris dusts were ineffective. Infested buildings can be fumigated with hydrocyanic acid gas, which kills all stages at a concentration of 1–1½ volumes per cent. but does not penetrate more than 8–10 ins. into flour and grain, and with Areginal, which gave complete mortality at the rate of 1 pint per 100 cu. ft. with an exposure of two days and penetrates readily to a depth of about 20 ins. in wheat. Fumigation with nicotine was ineffective in tests. Some control in houses might be given by setting out traps of corrugated paper filled with flour and destroying them at regular intervals, but this method has not been tested. The only natural enemy observed was *Cheyletus eruditus*, Schr., a predacious mite that is common in grain and cereal products and attacked the eggs and young larvae, but it does not afford much control. *Pediculoides ventricosus*, Newp., which occurred in some cultures of the beetle, was not observed to attack it.

Rivnay (E.). *Clausenia purpurea* **Ishii, a Parasite of** *Pseudococcus comstocki* **Kuw. introduced into Palestine (A Study on its Life-cycle, Ecology and Economic Status) (Hymenoptera : Encyrtidae).**—*Bull. Soc. Fouad 1er Ent.* **26** pp. 1–19, 8 figs., 6 refs. Cairo, 1942.

Citrus in Palestine is attacked by two or three closely allied species of *Pseudococcus* of which one is apparently *Pseudococcus comstocki*, Kuw. The Encyrtid, *Clausenia purpurea*, Ishii, which was introduced from Japan [*cf. R.A.E.*, A **30** 508], was found to parasitise these successfully, and a biological and ecological study was therefore undertaken to determine its resistance to the climate of the country, its habits and the likelihood of its controlling the mealybugs adequately. The parasite, all stages of which are described, was bred on *P. comstocki*, for which *Citrus* proved to be the most satisfactory foodplant. Attempts to rear it on *P. citri*, Risso, were unsuccessful. Both sexes developed from unfertilised eggs, but males were rare. The eggs were laid in very young larvae only 1 mm. long, older ones or mature females, but not in gravid or ovipositing females. Several may be deposited in a single female, but only one develops. The larvae pupate within the body of the host. The average number of offspring per female was 65 when the temperature fluctuated between 21 and 25°C. [69·8–77°F.], 55 at 26°C. [78·8°F.] and 29 at 30°C. [86°F.] ; the number of eggs decreased considerably at temperatures below 20°C. [68°F.]. The developmental period was 25–30 days at favourable temperatures, being shortest at 27°C. [80·6°F.], and it was calculated that the threshold of development was 9°C. [48·2°F.]. Some individuals survived in hosts exposed to 0–5°C. [32–41°F.] for as long as five days. The mortality of pupae (10 per cent.) was not increased by six days' exposure to 4–7°C. [39·2–44·6°F.], but gradually increased to 50 per cent. as the time of exposure was extended to 45 days, and the average number of offspring reared from the survivors decreased as the period of exposure increased. The adults lived longest at 15–19°C. [59–66·2°F.], when 50 per cent. lived for about four weeks, and an

average of 2–3 weeks at 20–30°C.; they were motionless or sluggish at temperatures below 15°C. Reproduction was negligible at 16–20°C. [60·8–68°F.] and ceased altogether at lower temperatures. Eggs were laid up to 35°C. [95 F.], but the eggs and larvae did not survive if constantly exposed to 33°C. [91·4°F.] throughout a great part of the development period.

It would appear from the work as a whole that there are about eight generations in the year in the coastal plain of Palestine. No oviposition takes place during September–March, when the average daily temperature is often below 16°C.; many larvae and pupae from eggs laid early in winter die, and the reproductive power of the remaining individuals, which mature in spring, is much reduced. Spring and autumn are the most favourable periods for development and activity, two generations with life-cycles of 45 days developing during March–May, when the average temperature is 17–22°C. [62·6–71·6°F.], and one within 60 days during October and November, when it is 15–20°C. From June to September, when the average daily temperature fluctuates between 22 and 27°C., there may be four generations, but the temperature often rises above 33°C., causing diminished reproduction and some larval mortality. Experiments showed that both larvae and pupae of *C. purpurea* are parasitised by an Encyrtid of the genus *Thysanus*, which was apparently attacking other Encyrtids on *Citrus* during the period of study, but the reproductive capacity of the hyperparasite was low.

A grove in which 25 adults of *Clausenia* per tree were liberated during 1940 showed 1 per cent. parasitism in March 1941, 4 per cent. in May and more than 70 per cent. at the end of August; very few mealybugs were found in March 1942 and more than 65 per cent. were parasitised. Similar results were obtained in other groves in which liberations were made, and the parasite was found in several in which it had not been liberated.

Taher Sayed (M.). **Contribution to the Knowledge of the Acarina of Egypt: I. The Genus *Raoiella* Hirst (Pseudotetranychinae-Tetranychidae).**—*Bull. Soc. Fouad 1er Ent.* **26** pp. 81–84, 3 pls., 8 refs. Cairo, 1942. **II. The Genus *Tenuipalpus* Donnadieu (Tetranychidae).**—pp. 93–98, 7 pls. **III. The Genus *Phytoptipalpus* Trägårdh (Tetranychidae).**—pp. 115–117, 3 pls. **IV. The Genus *Anychus* McGregor (Tetranychidae).**—pp. 125–127, 2 pls., 7 refs.

Descriptions are given of the Egyptian species of the four genera dealt with, and the characters and systematic position of the first three are discussed. The species comprise *Raoiella indica*, Hirst, on the leaves of date palms (*Phoenix dactylifera*), *Tenuipalpus oudemansi*, Geijskes, on apple, pear, plum and apricot, *T. orchidarum*, Parfitt, causing browning of the leaves of grape-vine and on leaves, small branches and occasionally fruits of pomegranate, *T. obovatus*, Donn., on *Citrus*, guava and occasionally on plum and apricot, *Phytoptipalpus paradoxus*, Trägårdh, on *Acacia nilotica*, and a species of *Anychus* on the leaves and fruits of *Citrus* and on castor (*Ricinus communis*) and some ornamental trees such as *Melia azadirachta* and *Albizzia lebbek*. The author uses the name *A. latus*, C. & F. ?, for this species, though he considers it doubtful whether it is actually the mite described by Canestrini & Fanzago as *Tetranychus latus*. It is the species recorded on *Citrus* in Palestine as *A. orientalis*, Zacher [*R.A.E.*, A **25** 749; **26** 405, of which he has received specimens, and he also has specimens of it from the Sudan.

Mohamed Soliman el Zoheiry. **A Contribution to the Morphology and Biology of *Erythroneura parvula* Boh. (Hemiptera-Homoptera: Jassidae-Typhlocybinae).**—*Bull. Soc. Fouad 1er Ent.* **26** pp. 151–162, 10 refs. Cairo, 1942.

The author reviews the literature on the bionomics of *Erythroneura parvula*, Boh., as a pest of vines in the Caucasus [*R.A.E.*, A **20** 151; **21** 10, and

records of its occurrence in greenhouses in England. He disagrees with the statement of E. I. MacGill [**20** 333] that most of the damage attributed to it in greenhouses is really caused by *E. pallidifrons*, Edw., since he carried out laboratory investigations on its biology for a year from October 1926, when it was abundant in the glass-houses of the Royal Botanic Gardens at Kew and caused injury to primroses and other seedlings. All stages of this Jassid and the processes of pairing, oviposition and hatching are described. There were eight generations in the year in the laboratory at a temperature of about 19°C. [66·2°F.], no hibernation occurred and the life-cycle lasted an average of 45 days, being shorter in hot weather and longer in cold. Mating usually took place 6–7 days after emergence, and the oviposition period began about a day later and lasted two weeks or more. The females deposited 57–92 eggs singly below the epidermis of a leaf vein or petiole, and these hatched in an average of 18–19 days ; small numbers of eggs were laid by unmated females, and a small proportion of these hatched. Local migration takes place, particularly when food becomes scarce or unsuitable, and the leafhoppers are apparently attracted to lights at night and to heat, as they can be found in numbers resting on the hot-water pipes used for heating the houses.

PASQUIER (R.). **Prévision et périodicité des invasions de la sauterelle pèlerine en Afrique du Nord. Les difficultés de la lutte au siècle dernier.**—*Bull. Soc. Agric. Algérie* **85** no. 509 repr. 20 pp., 14 refs. Algiers, 1942.

Exact forecasts of time and places of invasions by swarms of *Schistocerca gregaria*, Forsk., in North Africa, which would be of great value for the timely preparation of defensive measures, are impossible because the Saharan territories over which the swarms travel in winter are extensive, communications are inadequate, and knowledge of the meteorological conditions influencing migrations is insufficient. Therefore, only very general predictions can be made on the basis of winter reports, but even such approximate short-range forecasting is useful.

Long-range forecasting would also be important and might be feasible if a definite periodicity of invasions could be established. An analysis of the invasions of Algeria during 1844–1941 shows that there is no regular cycle, and statistically, there are even chances of an invasion occurring or not occurring in any year. When, however, the data on locust activity in the whole of north-western Africa are analysed, it appears possible to distinguish nine definite cycles since 1843, including the current one. The eight completed outbreak periods varied in duration, lasting about 9 ± 3 years, with intervals of $2{\cdot}5\pm1$ years between them, and the length of a full cycle was 9–15 years. This figure closely approaches that for the sunspot cycle, which is 9–14 years, as has already been suggested for Indian outbreaks [*R.A.E.*, A **27** 485]. The North African cycles usually begin up to five years later than the Indian ones, which may mean either that the outbreaks extend from east to west, or that conditions favouring the beginning of outbreaks do not arise in the two areas simultaneously. It must be remembered, however, that the outbreaks may actually begin two or more years before they are recorded. The beginnings of outbreaks usually coincide either with the ends of the minima of sunspots, or with the beginnings of the maxima. The outbreaks usually end during the period of decrease in sunspots. On the whole, invasions of North Africa may be expected to begin up to four years after the sunspot minima. This conclusion has small practical value for the organisation of anti-locust campaigns, but it may help to determine the periods when field investigations should be intensified.

The ecological reason for the correlation between sunspots and locust outbreaks may be the instability of climatic factors during the sunspot minima, since an analysis of rainfall data shows a greater variation during the minima, but further research is needed to confirm this hypothesis.

PASQUIER (R.). **Les sauterelles pèlerines. L'invasion actuelle, les recherches, la lutte.**—*Agria* no. 99 repr. 12 pp. Algiers, 1942.

The last cycle of invasions of *Schistocerca gregaria*, Forsk., in North Africa terminated in 1934 [*cf. R.A.E.*, A **23** 637], and the last swarms in the French Sudan were reported in 1936 [*cf.* **25** 506]. Subsequently, only locusts of the solitary phase were found in the Sahara [*cf.* **26** 239] and in Mauretania [*cf.* **26** 755] until May 1939, when breeding was observed in the central Sahara [*cf.* **28** 325], although it did not result in the production of swarms. Breeding in more or less scattered formation continued in 1940 and early 1941, but the first definite swarms of ph. *gregaria* appeared from an unknown source in June 1941 at Adrar des Iforas, Aïr and Hoggar [*cf.* **31** 425], as well as further west in Mauretania. By the early spring of 1942, swarms reached both Morocco and Algeria.

In the eastern African and Arabian regions, swarming of *S. gregaria* ceased in 1934 [*cf.* **23** 637], but incipient swarms were reported in 1935–38, and a new outbreak started in 1940. This suggests that the present cycle may have started in eastern Africa and spread westwards, although no data are available from the intermediate regions. It is equally possible, however, that incipient swarms formed independently in the central Sahara or the French Sudan. In either case, Mauretania appears to have been invaded from the east.

This uncertainty as to the origin of the new outbreak cycle is due to the very incomplete information service and to insufficient investigations. Research should be greatly expanded and an extensive organisation created before the next period of minimum locust activity. The considerable cost of such an organisation would be justified because the results of the investigations would permit the establishment of permanent control designed to prevent swarming.

As the present outbreak cycle has reached full development, it is too late to apply the method of preventive control. The vast extent of the territories invaded and the difficulties of communication and supplies render it hopeless to attempt total control over the whole region, and it is only practicable to organise the destruction of locusts where they present immediate danger to crops. The importance of organising an efficient information service is particularly stressed.

FENNAH (R. G.). **The Citrus Pests Investigation in the Windward & Leeward Islands British West Indies 1937–1942.**—66 pp., 9 pls., 20 refs. Trinidad, Imp. Coll. trop. Agric., 1942.

An account is given of investigations on the insect pests of *Citrus* and on other reasons for the failure of this crop in St. Lucia, Montserrat and Dominica, carried out in 1937–42. The first and longest section deals with the citrus weevils of the genus *Diaprepes*, including their life-history, food-plants and natural enemies, the damage they cause and methods of controlling them [*cf. R.A.E.*, A **29** 262, etc.], and the characters and distribution of the principal species ; the second comprises a list of the Coccids that infest *Citrus* in these three islands and St. Vincent [*cf.* **29** 262 ; **31** 165], with notes on the bionomics of the three most important species and methods of protecting the trees from attack ; and the fifth is on miscellaneous pests of *Citrus*. These include *Gymnandrosoma* sp., the larva of which feeds in the fruits of orange in Dominica [*cf.* **30** 608], and fruit-piercing moths that attack orange and grapefruit, of which *Gonodonta incurva*, Sepp, is most abundant in both Dominica and St. Lucia, *Othreis apta*, Wlk., *Perigea* (*Condica*) *cupentia*, Cram., *Mocis repanda*, F., and *Nymbis arcuata*, Wlk., have been taken in Dominica and *Zale fictilis*, Gn., in St. Lucia. *M. repanda* and *N. arcuata* have not been seen actually piercing uninjured fruits and may be only secondary pests. The wild food-plants of *Othreis* are menispermaceous vines and those of *Gonodonta* Annonaceae. Damage by the moths can be prevented by picking the fruit as soon as it matures.

The leaves are attacked by *Litostylus pudens*, Boh., in all three islands and also by *Eustylus hybridus*, Germ., in Dominica; both these weevils can be controlled if necessary by dusting or spraying with an arsenical. Mites stunt the new growth and cause lateral furrowing of the terminal shoots and can be prevented from spreading to new ones by a spray of nicotine sulphate and soap. *Toxoptera aurantii*, Boy., occurs on the young foliage of orange and lime in all the islands, but is controlled by the Syrphid, *Baccha conformis*, Lw., and Coccinellids. Various Tettigoniids feed on the leaves of grapefruit and orange in Dominica and could be controlled if necessary by sprays of lead arsenate.

The remaining sections contain discussions on the dying out of seedling limes owing to desiccation and partial incompatibility between lime and the sour orange on which it is usually budded, and notes on *Citrus* agronomy.

Landeiro (R.). *Dynamis politus* **Gyll.** (*Rhynchophorus politus* **Gyll.**). **Uma nova praga do coqueiro.** [A new Pest of Coconut.]—*Bol. Minist. Agric.* **30** (1941) no. 11 pp. 1–6, 4 figs. Rio de Janeiro, 1942.

In January and February 1941, healthy coconut palms (*Cocos nucifera*) in Espirito Santo were found to be infested by *Dynamis* (*Rhynchophorus*) *politus*, Gylh. The only food-plant from which this weevil has previously been recorded in Brazil is *C. schizophylla* [*cf. R.A.E.*, A **11** 120], but Bondar has also observed it on *C. vagans*, which it often kills by destroying the bud. As it prefers developing tissues, it may prove more harmful to coconut than *Rhynchophorus palmarum*, L., which feeds mainly on dead material. The characters differentiating the two species are tabulated. The adult oviposits in the terminal shoot, and the larva tunnels down the stem, within which it pupates. Water enters the tunnel and causes fermentation of the tissues, which hastens the death of the palm. The complete developmental cycle requires at least six months, whereas that of *R. palmarum* takes only 55–70 days.

Se decretaron nuevas medidas para combatir el " gorgojo pardo." [New Measures decreed against *Conotrachelus denieri*, Hust.]—*Bol. Junta nac. Algodón* no. 95 p. 178. Buenos Aires, 1943.

The text is given of a decree (no. 145386 of 18th March 1943) prescribing measures to prevent the spread of *Conotrachelus denieri*, Hust., from the infested areas in the departments of Pilcomayo and Pilagás, Territory of Formosa [*cf. R.A.E.*, A **30** 423], to other parts of Argentina. It requires all cottonseed in these departments to be disinfested immediately after ginning, prohibits the export from them of any non-disinfested cotton plants, plant parts or products liable to infestation, and orders that all material contravening these provisions be burnt at once.

Lizer y Trelles (C. A.). **Apuntaciones coccidológicas. I.**—*Rev. Soc. ent. argent.* **11** no. 4 pp. 319–335, 2 figs., many refs. Buenos Aires, 1942. **II.**—*T.c.* no. 5 pp. 455–460, many refs. 1943.

Coccids recorded for the first time in Argentina include *Pseudococcus maritimus*, Ehrh., on beet, peas and carrots, *Saissetia nigra*, Nietn., on cherimoya (*Annona cherimolia*), *Aspidiotus* (*Hemiberlesia*) *diffinis*, Newst., on tung (*Aleurites fordi*) and white quebracho (*Aspidosperma quebracho-blanco*) and *Parlatoria blanchardi*, Targ., on date palms of North African origin (all in the first paper) and *Phoenicococcus marlatti*, Ckll., on the same date palms and *Lecanium* (*Eulecanium*) *corni*, Bch., on various fruit and forest trees (in the second). The first paper also contains records of the fungi, *Septobasidium saccardinum* and *S. castaneum*, developing on *Clavaspis herculeana*, Doane &

Hadden, on tung, and a summary of the literature on the status of *Pseudococcus vitis*, Nied., which occurs on vines in Argentina [*cf. R.A.E.*, A **28** 373] and elsewhere and is doubtfully distinct from *P. citri*, Risso.

Blanchard (E. E.). **Nuevos dípteros e himenópteros parásitos, de la República Argentina.** [New parasitic Diptera and Hymenoptera of Argentina.]—*Rev. Soc. ent. argent.* **11** no. 4 pp. 340–379, 17 figs. Buenos Aires, 1942.

The new species described include *Sarcophaga* (*Protodexia*) *australis* and *S.* (*Tephromyiella*) *neuquenensis* from *Trigonophymus* (*Dichroplus*) *elongatus*, Giglio-Tos, *S.* (*P.*) *crouzeli* from *Elaeochlora viridicata*, Serv., the Tachinids, *Clistomorpha* (*Hyalomyodes*) *argentinensis* from *Epicauta adspersa*, Klug, *Pronemorilla kreibohmi* and *Ypophaemyia haywardi* from *Prodenia ornithogalli*, Gn., and the Aphelinids, *Aneristus coccidis* from *Coccus* (*Lecanium*) *hesperidum*, L., *Ablerus magistrettii* from *Chrysomphalus paulistus*, Hemp., and *A. leucopidis* from a pupa of a species of *Leucopis* attacking *Ceroplastes grandis*, Hemp., and from *Eriococcus mendozae*, Morrison, probably attacked by *Leucopis*.

Sellers (W. F.). **The Nearctic Species of parasitic Flies belonging to *Zenillia* and allied Genera.**—*Proc. U.S. nat. Mus.* **93** no. 3157 pp. 1–108, 5 refs. Washington, D.C., 1943.

This paper is a revision of the Tachinids that were referred to the genus *Zenillia* by Aldrich & Webber, but which the author divides into the genera *Zenillia*, *Phryxe*, *Carcelia*, *Aplomya*, *Sisyropa*, *Thelymyia* and *Angustia* (gen. n.). It also includes some Palaearctic species of the first four genera and some Neotropical species of *Zenillia*, *Carcelia* and *Chrysophryxe* (gen. n.).

[The characters used by the author to define these genera are not the same as those used in Mesnil's recent proposals for a comprehensive classification of the Tachinids [*R.A.E.*, A **28** 320], and there are consequently some differences in their scope. Until agreement has been reached on this problem, it would seem most convenient in collating the names for reference in this *Review* to retain the conception of Aldrich & Webber except for *Carcelia*.]

Martineau (R.). **Population Studies of the European Spruce Sawfly (*Gilpinia hercyniae* Htg.) in Quebec.**—*For. Chron.* **19** no. 2 repr. 23 pp., 1 fig., 7 graphs, 12 refs. Toronto, 1943; also as *Contrib. ent. Serv. Dep. Lds For. Quebec* no. 19.

Population studies on *Gilpinia hercyniae*, Htg., were made in the Gaspé Peninsula and Matapedia Valley areas of the Province of Quebec in 1938–40 in an attempt to correlate its abundance with the ecological factors of the spruce habitat [*cf. R.A.E.*, A **31** 285]. They were based on the collection of cocoons from the soil along strips about 18 ins. wide connecting the trees in six sampling plots, varying in area from 900 to 2,500 sq. ft., situated in an old and a young stand of black spruce [*Picea mariana*], a pasture stand of white spruce [*P. glauca*], two other stands of *P. glauca*, both comprising young trees, of which one was dense and the other open, and a mixed stand of balsam fir [*Abies balsamea*] and the two spruces. The characters of these plots, including their aspect, characteristic plant species, the depth of the humus layer, the number, average age and size of the trees, the estimated amounts of defoliation and numbers of larvae per tree, and details of the cocoon population are given in a table.

It was found that, except in the stands of *P. mariana*, the percentage of cocoons from which adults had emerged was highest where the layer of humus was 4–6 ins. deep. Where there was less humus, the humidity was reduced by increased evaporation and where there was more, the temperature was probably

too low for successful emergence. This factor was less important in stands of *P. mariana*, where the humus was so saturated and the ground temperature so low that there was little difference in these conditions at various depths. Small mammals destroyed most cocoons where the humus layer was thick, since this provides both shelter for the mammals and a suitable site for their hoards, but mortality due to parasites did not appear to be correlated with humus depth. Sunlight appeared to favour the emergence of the adults ; cocoons were most abundant on the south side of the trees and least on the north, and approximately equal proportions occurred on the east and west. According to A. R. Gobeil, 70 per cent. of the full-fed larvae remain within 1 ft. of the point at which they reach the ground and none travels more than $2\frac{1}{2}$ ft. ; the disposition of the cocoons thus suggests that the larvae prefer to feed on the sides receiving most sunlight. The percentage of cocoons from which adults had emerged (based on counts of these and sound cocoons only) was found to increase and the mortality percentage (based on counts that excluded cocoons attacked by parasites or predators) to decrease with the humidity of the surroundings. The percentages of cocoons from which adults had emerged were 70·9 in stands of *P. mariana*, which are almost confined to swampy and undrained soils, 55·2 in the mixed stand, in which the humidity was lower, and only 37·8 under *P. glauca*, which occurs on the driest sites. The corresponding mortality percentages were 14, 32 and 34·8, but the last figure (average for *P. glauca*) is abnormally low because of exceptionally low mortality (2 per cent.) in the open stand of young trees ; it is suggested that larvae that feed on young foliage acquire greater resistance.

Of a total of 648,580 cocoons collected in the plots during the three years, 60·4 per cent. had been attacked by small mammals, but this proportion, which was obtained from data from heavily infested areas, is probably rather high for the entire region. Shrews, mice and squirrels are the chief predators concerned, and M. L. Prebble stated in a letter to the author that the shrews, *Blarina brevicauda* and *Sorex cinereus*, are the most important. Only 1·1 per cent. of the cocoons were found to be parasitised, but this percentage is probably too low, since some cocoons were found before parasites entered the plots. Data from observations on the rate of growth of the trees since 1923 show a general reduction, which is greatest in the dominant trees and can probably be attributed to infestation by *G. hercyniae*.

Beal (J. A.). **Relation between Tree Growth and Outbreaks of the Black Hills Beetle.**—*J. For.* **41** no. 5 pp. 359–366, 9 graphs, 9 refs. Washington, D.C., 1943.

In order to determine whether there is any relation between deficient rainfall and outbreaks of *Dendroctonus ponderosae*, Hopk., which caused exceptionally heavy losses of ponderosa pine [*Pinus ponderosa*] in the central Rocky Mountain region from about 1932 to 1939 [*cf. R.A.E.*, A **28** 223], or between these outbreaks and the growth rate of pines, rainfall data were obtained for the years preceding, during and if possible following some of the more important recent outbreaks, and increment cores were taken from healthy pines in the outbreak districts. Although the correlation between annual rainfall and rate of tree growth during individual years was not always particularly close, rainfall variations of longer duration were reflected in the growth rate ; during prolonged periods of drought, radial growth was reduced in proportion to the severity of the drought. Of the thirteen outbreaks studied, nine began and developed during years of deficient precipitation, when tree growth was subnormal, two apparently began in wet years when tree growth was up to or above normal, but increased in aggressiveness during years of slightly reduced rainfall, when growth was subnormal, and two appear to have originated and continued in years of only slightly subnormal rainfall and tree growth. As most of the recent

outbreaks have been artificially controlled, other limiting factors that might have contributed to their end have been obscured, but nine outbreaks terminated when the growth rate was on the increase and was near normal or above, whereas four subsided when growth was subnormal. Outbreaks of *D. ponderosae* are apparently as destructive in the arid sections of its range as in the more humid ones, and examination of developing broods during some of the driest periods of recent years showed them to be abnormally heavy and to all appearances healthy and vigorous. Even though rainfall is normal, the rate of growth of pines may decline as a result of age or stagnation of the stand through crowding or other causes, and it is considered possible that outbreaks that coincided with periods of normal rainfall may be due, in part at least, to one or more of these factors.

EYER (J. R.). **Life History and Control of the Giant Apple Root Borer.**—*Bull. New Mexico agric. Exp. Sta.* no. 295, 14 pp., 10 figs., 1 ref. State College, N. Mex., 1942.

Most of the information in this bulletin on the life-history and control of *Prionus californicus*, Motsch., in southern New Mexico, where it is most injurious to apple, but has occasionally been taken from peach, plum, pear and quince, has been noticed from an earlier bulletin [*R.A.E.*, A **16** 681] and annual reports [**21** 450 ; **22** 321 ; **23** 284], but the concentration of paradichlorobenzene per U.S. pint petrol required to give complete control of larvae in artificial shelters buried two feet below the soil surface is given as $1\frac{1}{2}$ instead of $3\frac{1}{4}$ oz. [*cf.* **23** 284] and the chemicals with which tree bands were treated as alpha-naphthylamine (instead of alpha-naphthol) and beta-naphthol [*cf.* **22** 321].

To protect orchards from infestation, it is recommended that the trees should be kept vigorous by the use of fertilisers, particularly on light sandy soils, and that soils of the latter type should be avoided if possible when planting new orchards. Trees up to six years old can be protected by banding with strawboard treated with beta-naphthol or alpha-naphthylamine, placed tightly round the base and projecting down into the soil for at least two inches, from about 1st June, just before the emergence of the adults, until 1st August, or with $\frac{1}{2}$ oz. paradichlorobenzene per year of the tree's age, mixed with sand or loam and cultivated into the surface soil immediately round the base, or 1 U.S. quart 4 per cent. ethylene-dichloride emulsion poured round it ; neither paradichlorobenzene nor ethylene dichloride should be allowed to touch the tree trunk or roots. Older orchards in which infestations are found should be treated at least every other year, preferably during early autumn or late spring, when soil temperatures are at least 60°F., with $1\frac{1}{2}$–2 oz. paradichlorobenzene in 1 U.S. pint petrol to each foot of tree circumference, applied in a trench 4–6 ins. deep and 12–18 ins. from the trunk ; the trench should be filled with well pulverised earth, and a mound of earth extending out several feet should be piled over it and against the trunk of the tree. The concentration of paradichlorobenzene may be doubled for very large trees with extensive root systems, but this chemical should not be used at dosages heavier than those recommended or more than once a year and should not be applied immediately before or after irrigation, and the residue should be removed from nursery stock and young trees after several weeks.

SHULL (W. E.) & WAKELAND (C.). **The Mineola Moth or Destructive Prune Worm.**—*Bull. Idaho agric. Exp. Sta.* no. 242, 7 pp., 7 figs. Moscow, Idaho, 1941. [Recd. 1943.]

Since 1925, when *Mineola scitulella*, Hulst, was first observed attacking prunes in Idaho, this Pyralid has spread to probably all the prune-growing districts in the south-west of that State and also to south-eastern Oregon.

Brief descriptions are given of all stages, together with characters distinguishing the larva from that of the peach twig borer [*Anarsia lineatella*, Zell.], which it somewhat resembles, and of its life-history [*cf. R.A.E.*, A **20** 695]. Experiments have shown that it is best controlled by a spray of $2\frac{3}{4}$ pints pyrethrum extract (oil extract containing 2 gm. pyrethrins per 100 cc.) in 100 gals. oil emulsion (containing 4 gals. emulsified oil), applied 2–6 days after 95 per cent. of the overwintered larvae have emerged from their hibernacula, which is about the time that the buds show green at the tips and just before they begin to show white. This spray is effective at temperatures as low as 50°F., whereas nicotine sulphate, which also showed some promise as a spray against the overwintered larvae, was effective only at temperatures above 70°F., which are unusual in the early spring. Infestation by *Mineola* is usually light on trees that are sprayed annually in the dormant period with lime-sulphur against San José scale [*Aspidiotus perniciosus*, Comst.], *Anarsia lineatella* and mites, though lime-sulphur has little value as a direct means of control.

Reynard (G. B.). **"Red Ring" of Tomato Stems caused by an Insect, *Cyrtopeltis varians* (Dist.), at Charleston, S.C.**—*Phytopathology* **33** no. 7 pp. 613–615, 1 fig., 6 refs. Lancaster, Pa., 1943.

The Capsid, *Engytatus geniculatus*, Reut. (*Cyrtopeltis varians*, Dist.), was observed attacking tomato in South Carolina in 1941 and 1942. The bugs girdled the stems and petioles with punctures, which later turned reddish-brown, but the flowers were not attacked. A similar form of injury has been observed in Texas and Arizona [*R.A.E.*, A **19** 364].

Richards jr. (A. G.). **The interfibrillar Material in the central Nervous System of Mosquito Larvae** (*Culex pipiens*).—*Biol. Bull.* **83** no. 2 p. 300. Lancaster, Pa., 1942. **Lipid Nerve Sheaths in Insects and their probable Relation to Insecticide Action.**—*J. N. Y. ent. Soc.* **51** no. 1 pp. 55–65, 2 pls., 33 refs. Lancaster, Pa., 1943.

It was shown in previous work on larvae of *Culex pipiens*, L. [*R.A.E.*, B **30** 124] that toxic petroleum oils cause a degeneration that seems largely a separation of the individual nerve tissues and their processes, and in studies on the action of toxic oils, reported in the first paper, it was observed that oil solvents marked with Sudan dyes penetrated electively into the nervous system from tracheae. Correlation of these data resulted in the hypothesis that insect nerve cells and their processes are surrounded and insulated by some lipid material. This was confirmed in investigations described in the second paper, in which the insects examined comprised, in addition to the mosquito larva, *Gryllulus* (*Gryllus*) *assimilis*, F., *Phymata erosa*, L., *Harpalus* sp., *Bombus* sp. and *Eristalis tenax*, L. They showed that insect nerve cells and their processes are surrounded by bound lipid sheaths of submicroscopic thickness, and solubility data suggested that the lipids are phospholipids, perhaps with the addition of cholesterol. The lipid nerve sheaths are correlated with and so probably condition the penetration of oil solvents such as xylol into the nerve system from tracheae. Presumably this finding will apply also to the penetration of toxic oils and oil-borne toxins, such as pyrethrins, the neurotoxic action of either of which appears to involve the destruction of the lipid nerve sheaths. Sheath degeneration also occurs as a relatively early post-mortem change in asphyxiated mosquito larvae, but it is not known whether it is directly concerned in the production of paralysis and death. Some aspects of the relationship of these data to the study of insecticide physiology are discussed.

STURM (H.). **Untersuchungen über Buschhornblattwespen** (*Diprion*). [Investigations on Diprionine Sawflies.]—*Z. angew. Ent.* **29** pts. 3–4 pp. 412–442, 601–635, 13 figs., 30 refs. Berlin, 1942.

The numerous observations recorded in this paper were made in pine stands in Mecklenburg in 1937–40, largely by means of an outdoor insectary and cages fixed to the trees, and the results are compared with those of other workers, particularly Hsin [*cf. R.A.E.*, A **23** 84, 596]. The species observed were *Diprion similis*, Htg., *D. pini*, L., *Gilpinia* (*D.*) *pallida*, Klug, *G.* (*D.*) *socia*, Klug, *G.* (*D.*) *virens*, Klug, *G.* (*D.*) *frutetorum*, F., *G.* (*D.*) *laricis* var. *fenestrata*, Ensl., *G.* (*D.*) *variegata*, Htg., *Neodiprion* (*D.*) *sertifer*, Geoffr., and *Macrodiprion* (*D.*) *nemoralis*, Ensl. That studied in greatest detail was *D. similis*, which is considered to be characteristic of the group. The ratio of males to females ranged from 1 : 1·6 to 1 : 6, and it appeared that a male generally paired with more than one female. Females that oviposited soon after emergence lived for up to 19 days, with an average of 9, and males for 11 days. The eggs were generally laid in the needles of the previous year, and individual females laid 31–148. The minimum durations of the egg and larval stages were 42 and 31–44 days for eggs laid on 8th April, 23 and 38–50 for those laid on 5th May, 9 and 28–39 for those laid on 25th July and 13 and 43–56 for those laid on 27th August.

Investigations on the number of generations a year showed that in the field there are two, but increasing percentages of the first-generation larvae that spun their cocoons after mid-July diapaused. In the laboratory, however, three generations were produced in the year. Whether diapause began early or late, it was sometimes prolonged in the spring so that the adults did not emerge until late July, as compared with April for individuals that overwintered normally. Some cocoons collected in 1936 gave rise to adults in 1939, but no field evidence of such a prolonged diapause was found.

Observations on abiotic causes of mortality of the developmental stages were carried out in cages on the trees, but were somewhat inconclusive. Mortality of the eggs was caused by the drying of the needles in which they had been deposited, which was greater in needles of the current year's growth than in those of the previous year, but the causes of the almost complete larval mortality in some of the cages were not explained. In some cases, the caged larvae were killed by the fungus, *Empusa aulicae*. Eonymphs in their cocoons were resistant to extremes of temperature and survived exposure to −11°C. [12·2°F.] in winter.

The other sawflies are dealt with much more briefly. *D. pini* was not among the species taken by Hsin in Mecklenburg in 1935 [*loc. cit.*], but has since become gradually more numerous and caused a certain amount of defoliation in some districts in 1940. It had one generation a year in some areas, with eggs in June–July, and two in others, with eggs in April–May and early August, but experiments to obtain two generations from material of a one-generation strain were unsuccessful. *N. sertifer* is not particularly common in Mecklenburg. Adult emergence began on 25th August, but only 81·1 per cent. of the cocoons gave rise to adults, about half the others being killed by fungi. The ratio of males to females was 1 : 3·2. Adults of *G. pallida* emerged in cages from 14th April to 15th May in 1939, but did not oviposit, and those of the first generation were present in the field from 12th July to 5th August. Larvae of the second generation spun their cocoons from 19th September to 12th October.

G. socia was the rarest of the species studied. It has been considered to prefer damp localities, but was found by the author in a distinctly dry one. The adults emerged in the last 10 days of May, and those of the first generation at the end of July and the beginning of August. The resulting larvae had spun their cocoons by the end of September. The eggs swell during development in the needles, and up to 15·9 per cent. of them were killed by the resulting pressure in experiments.

M. nemoralis was rare near Rostock, but fairly common in southern Mecklenburg. The adults emerged from 13th April to the end of May, and those of the first generation were present from late July to mid-August. Adults of *G. frutetorum* emerged in the field from the beginning of April, and those of the first generation from 4th July to 20th August, and *G. laricis* var. *fenestrata* also had two generations in the year, with adults in the first half of May and the first half of August. *G. variegata* and *G. virens* were uncommon ; adults of the overwintered generation of both emerged in April and May, and those of the first generation in the second half of July and the first half of August. The eggs of all these sawflies are laid in the needles, but there are differences in their situation and arrangement ; a key based on these characters and their appearance is given. It is stated that the eggs described by Hsin as those of *G. socia* [**23** 597] were in reality those of *N. sertifer*.

Natural enemies of the various stages of the sawflies are discussed at some length. Predators that killed the adults included *Troilus luridus*, F., *Picromerus bidens*, L., *Rhynocoris annulatus*, L., Asilids and spiders. The eggs were destroyed by *Forficula auricularia*, L., and, in the laboratory, by *Raphidia notata*, F., feeding larvae by various Coccinellids, *Troilus*, *Picromerus*, *Rhynocoris annulatus* and, in some cases, *Formica rufa rufo-pratensis*, Forel, and the cocoon stages by mammals, particularly rodents, birds, Carabids, Staphylinids and the larvae of various Elaterids that were common in the forest. Egg parasites were not numerous, and attacked only species such as *G. frutetorum* and *G. variegata*, the eggs of which are not covered with secretion. In one district, 37·5 per cent. of the eggs of *N. sertifer* were parasitised by *Teleas* sp. Many parasites of the larvae and cocoon stages were observed, but their relative importance differed much from that recorded by Hsin [**23** 597] ; the most important were *Microcryptus subguttatus*, Grav., and *Holocremnus frutetorum*, Thoms., on *D. similis* and the latter also on *M. nemoralis*, and *Microplectron fuscipenne*, Zett., on *G. pallida*. These parasites were not specific, however, and *Microcryptus subguttatus* also attacked cocoons of *D. pini* in one locality and in experiments those of *Gilpinia frutetorum*. *Ichneumon nigritarius*, Grav., *Blondelia* (*Lydella*) *nigripes*, Fall., and *Holocremnus frutetorum* were bred from both *Bupalus piniarius*, L., and Diprionine sawflies, but *Holocremnus* was the only one at all numerous, so that the presence of sawflies is not likely to affect the course of outbreaks of *Bupalus*.

Ene (I.-M.). **Experimentaluntersuchungen über das Verhalten des Maikäferengerlings** (*Melolontha* **spec.).** [Experimental Investigations on the Larvae of *Melolontha melolontha* and *M. hippocastani*.]—*Z. angew. Ent.* **29** pt. 4 pp. 529–600, 23 figs., 53 refs. Berlin, 1942.

A detailed account is given of laboratory and field observations in Prussia on the seasonal migrations of cockchafer larvae in the soil. The material used comprised *Melolontha melolontha*, L., and *M. hippocastani*, F., but the species are little differentiated in the presentation of the results.

The following is based on the author's summary. The ascent of the larvae in spring was stimulated by warmth, and the rate at which it proceeded varied with temperature, but was greater after March than earlier in the year. They reacted to touch at 3–4°C. [37·4–39·2°F.], but remained motionless at lower temperatures. They began to move at about 7°C. [44·6°F.], burrowed actively in the soil at 10°C. [50°F.] and began to feed at 11·5°C. [52·7°F.]. Migration occurred normally in soil with humidity of 6–9 per cent., but in completely dry sand only some of the larger larvae were able to ascend. Lack of food after hibernation also stimulated the ascent, and under these conditions the larger larvae sometimes ate the smaller ones.

Daily variations in temperature during the vegetation period did not influence the depth at which the larvae occurred, but they descended to greater depths if

the soil moisture fell below 3 per cent. They were killed by flooding if completely surrounded by water for at least four days, since this cut off the oxygen supply, but survived longer beneath a layer not readily permeable by the water.

The autumn descent was stimulated by cold and began at about 10–11°C. [50–51·8°F.]. It was most rapid after October, but was delayed by warmth. The depth at which hibernation took place depended largely on temperature and the nature of the soil.

Böhmel (W.) & Jancke (O.). **Beitrag zur Embryonalentwicklung der Wintereier von Aphiden.** [A Contribution to the embryonic Development of the Winter Eggs of Aphids.]—*Z. angew. Ent.* **29** pt. 4 pp. 636–658, 17 figs., 19 refs. Berlin, 1942.

Winter sprays against insect pests of fruit trees are generally considered in Germany to increase in effectiveness the nearer their date of application is to the time when the buds open, but experiments by Jancke have shown that overwintering larvae of *Hyponomeuta*, young Coccids and Aphid eggs can be destroyed in mid-winter just as easily. The Aphid eggs must therefore be well advanced in development before the beginning of winter, and in order to verify this, observations were made on the development of the embryos in winter eggs of *Lachnus rosae*, Cholodk., and *Aphis pomi*, Deg. The results are recorded in detail. They showed that development is very similar in both species, and that the formation of the extremities, mouthparts and digestive and nervous systems was largely completed by December. The eggs are then as susceptible to tar distillates and other contact poisons as in spring, so that sprays may well be applied against them in mid-winter.

Gösswald (K.). **Die Massenzucht von Königinnen der kleinen roten Waldameise im Wald.** [Mass Breeding in Forests of Queens of the small Red Forest Ant.]—*Z. angew. Ent.* **29** pt. 4 pp. 659–683, 11 figs., 10 refs. Berlin, 1942.

The plan to employ the red forest ant, *Formica rufa*, L., against forest pests in Germany [*cf. R.A.E.*, A **31** 76] requires suitable utilisation of the often scanty populations. Splitting up the nests is uneconomic and not always successful biologically, and a considerable increase in colonies must be based on an increased supply of queens. The author has therefore evolved a method of breeding queens that avoids the great mortality among them that occurs in nature. There are several varieties and forms of this ant, and they differ somewhat in habits. These are reviewed, and it is concluded that the most suitable for distribution are certain forms of *F. rufa rufo-pratensis*, Forel, which are preferable because of their more marked predatory instincts and greater production of queens and nests. Factors that influence pupal development and pairing are discussed.

A suitable nest in the forest is enclosed in an octagonal cage of wire gauze sunk into the soil, each side of which has five openings at ground level that can be closed by means of metal slides. Material containing pupae selected by sex is collected elsewhere and scattered over the nest, into which the pupae are carried by the worker ants. When the males and females are emerging from these pupae, the slides in the openings are closed sufficiently to prevent their escape but not the movements of the workers, and the males and females are collected at short intervals and transferred to a large glass vessel such as is used for an aquarium, the bottom of which is covered with a layer of moist plaster and which contains three sheets of peat one above the other. Pairing takes place in this vessel, and after the fertilised females have shed their wings they are placed in batches of 100 in glass tubes for distribution. Up to 100,000 have been obtained from one nest in a year.

[Gilyarov (M. S.).] Ghilarov (M. S.). **Naphthalene as a Means to control Seed Pests of biennial Kok-saghyz.**—*C. R. Acad. Sci. URSS* (N. S.) **37** no. 3 pp. 109–112, 4 refs. Moscow, 1942.

The larvae of *Olibrus bicolor*, F., and *Ceuthorrhynchus punctiger*, Gylh., cause a considerable reduction in the yield of seed of kok-saghyz [*Taraxacum kok-saghyz*] in the Russian Union [*R.A.E.*, A **30** 408] and the usual insecticides are not effective against them as they are sheltered within the flower-heads. Naphthalene dust, which would have some fumigant action, was therefore tested against them on field plots of infested dandelion (*T. officinale*) in Moscow in 1940. It was applied by hand to the flower-heads at the rate of 0·9 lb. per acre on 30th May and examination of the flower-heads was begun on 3rd June. The percentages that contained living and dead larvae of *Olibrus* were 24·2 and 17·2 on the dusted plants and 75·5 and 0·7 on the control ones and the corresponding percentages for *Ceuthorrhynchus* were 5·7, 2, 22 and 0. It was evident that the naphthalene caused some of the larvae to leave the flower-heads prematurely ; larvae of *Ceuthorrhynchus* that do this never survive. In 1941, naphthalene, pyrethrum powder, oxydiphenyl and dioxydiphenyl were applied at the rate of 2 mg. per flower-head (equivalent to about 20 lb. per acre) to dandelions in an out-door insectary and a spray of pyrethrum extract was also used. The naphthalene proved far more effective than the other insecticides and killed or drove out almost all the larvae of both species when applied at mean temperatures of about 17°C. [62·6°F.], but its efficiency was much reduced at about 11°C. [51·8°F.]. It did not injure the plants or impair the viability of the seeds.

Harris (W. V.). **Insects injurious to Cotton in Tanganyika Territory.**—*Pamphl. Dep. Agric. Tanganyika* no. 29, 11 pp., 3 pls. (2 fldg.). Dar es Salaam, 1942.

The author gives a short account of the cultivation of cotton in Tanganyika, a list of 119 insects that feed on the crop, classified according to the part of the plant attacked, notes on the bionomics and importance of the more injurious of these [*cf. R.A.E.*, A **25** 79], a map showing the areas in which cotton is grown and climatographs of the coastal plain and the lake basin.

Ananda Rau (S.). **Report of the Entomologist 1941–42.**—*Rep. sci. Dep. Tea Sect. U.P.A.S.I. 1941–42* pp. 18–26. Madras, 1942.

Further observations in south Travancore in 1941–42 on the duration of the effect on yield of pruning and tipping tea for the control of *Helopeltis* showed considerably less difference between treatments than were found in the previous year [*cf. R.A.E.*, A **30** 336], and it is concluded that the type of pruning and tipping has no effect on either the crop or the incidence of the pest during the second year after treatment. In tests with a poisoned sugar bait [**30** 211] against a limited number of individuals of *H. theivora*, Waterh., collected on *Jussieua suffruticosa*, the insects fed on the solution and were dead in 48 hours. Infestation of tea by *Helopeltis* was particularly severe in south and central Travancore on estates normally liable to serious attacks, and, probably owing to rather heavy early rains in March and April, reached its peak as early as September, though heavy losses were sustained until the end of December. An unidentified thrips, observed in south Travancore in September, caused stunting and probably reduced the crop over several acres. The attack may have been due to poor health of the bushes, possibly owing to the drought of the last 2–3 years, and, if necessary, measures should be taken to increase their vigour. Other insects reported on tea included *Saissetia coffeae*, Wlk., *Zeuzera coffeae*,

Nietn., and *Anoplocnemis phasiana*, F., which was stated to have attacked the young leaves, though this Coreid has not previously been recorded damaging tea.

A species of *Kalotermes* was reported from trees of *Grevillea* that were dying back, but the exact nature of the damage could not be ascertained. *Albizzia*, which is receiving increased attention as a shade tree for tea, was attacked by an undetermined Hepialid referred to as *Phassus* sp. [*cf.* **31** 158], which bored in the main stems of young plants at Wynaad, Malabar and Cochin and was also reported from young plants of red gum [*Eucalyptus rostrata*] in the Anamallais, and a species of *Indarbela*, probably *I. quadrinotata*, Wlk., attacking the bark in south Travancore. Extensive outbreaks of the latter borer are generally regarded as indicating an unhealthy condition of the trees, and measures to improve their condition should be taken ; if direct control is necessary, the matted frass from the borings should be rubbed off and burnt and the tunnel entrances and other irregularities on the tree painted with tar by means of a stiff brush fitted at right angles to the end of a bamboo pole. A combined severe attack of the Membracid, *Oxyrhachis tarandus*, F., and a species of *Pseudococcus* was observed on a large number of *Albizzia* trees on an estate in south Travancore. The former caused severe stunting of new shoots, some of which were dying ; nymphs and adults were thickly crowded on the shoots, and eggs were numerous in slits in the bark. Pierids of the genus *Terias*, which occasionally defoliate *Albizzia* wherever it is grown, were reported from the Anamallais and south Travancore. The Pentatomid, *Cyclopelta siccifolia*, Westw., caused considerable damage to dadap (*Erythrina*) on an estate in south Travancore, the nymphs and adults feeding on the sap of the twigs in large numbers ; since the bugs are gregarious and sluggish, they may be controlled by brushing them off the twigs into a tin of water and kerosene. The beetle tentatively identified as *Sthenias grisator*, F., was less injurious than in the previous year [*cf.* **30** 337] ; collecting any adults found and cutting and burning all girdled twigs are the only control measures known.

Basir (M. A.). **Nematodes parasitic in** *Gryllotalpa*.—*Rec. Indian Mus.* **44** pt. 1 pp. 95–106, 5 figs., 10 refs. Delhi, 1942.

Descriptions are given of five new species of Oxyurid worms, four belonging to new genera, all of which were found in the intestines of mole-crickets (*Gryllotalpa* sp.) in the Aligarh district of the United Provinces. Nearly all of a very large number of mole-crickets dissected contained one or more of them. A key to the genera of the subfamily Thelastomatinae, to which these Oxyurids belong, is appended.

Negi (P. S.). **Artificial Control of the Enemies of Lac Insects and Lac. Part I : Water-immersion.**—*Bull. Indian Lac Res. Inst. Namkum* no. 50, 9 pp., 1 pl., 1 ref. Ranchi, 1942.

Over 40 per cent. of the lac crop in India is destroyed each year by insect predators and parasites of the lac insect [*Laccifer lacca*, Kerr], the predators, of which *Holcocera pulverea*, Meyr., and *Eublemma amabilis*, Moore, are the most important, being responsible for a loss of 35–40 per cent. and parasites for a further 5–10 per cent. Biological and cultural methods are not entirely satisfactory against these insects, and other measures are therefore required to supplement them. Of the two available methods, fumigation [*R.A.E.*, A **18** 638] is not practicable in the villages and immersion in water [**31** 295], which is cheap and easily carried out, is therefore recommended for all the crop except that required for brood. Its efficiency is shown by the fact that the total numbers of insects other than *L. lacca* that emerged from treated and untreated lac were 136 and 26,203, the samples yielding about 62 and 40 lb. scraped lac,

respectively. Detailed instructions for the application of this method and the results of experiments showing that it has no deleterious effect on the yield of seed lac and shellac or on the physical and chemical properties of the shellac manufactured are given.

COTTIER (W.) & SPILLER (D.). **The Dicky Rice Weevil** (*Maleuterpes spinipes* **Blkb.**).—*N.Z. J. Sci. Tech.* **23** no. 4A pp. 213A–222A, 7 figs., 6 refs. Wellington, N.Z., 1942.

In New Zealand, *Maleuterpes spinipes*, Blkb., has been found only in Kerikeri and Auckland [*cf. R.A.E.*, A **27** 21], but has caused serious damage to lemon and orange trees since 1938. The eggs are laid in the soil under the trees, and the larvae feed on the roots, but apparently cause no reduction in the vigour of the trees. The adults eat small pieces out of the fruits when they have just started to grow, with the result that many of them fall prematurely and others are blemished when mature; they also destroy the young foliage that develops from the base of the tree, and nursery trees are often severely retarded by damage to the new growth. Collection records in Auckland indicate that, though adults may be found throughout the year, there are two generations annually, as evidenced by two main periods of emergence. One of these is from late November to about the end of February, with a peak between the middle of December and January, and the other from late April to mid-July, with a peak early in June.

Pruning the trees to keep all foliage 18 inches from the ground, keeping the soil free from weeds and banding the trees in October with an adhesive, applied to waxed paper tied round each trunk just below the lowest branches, protected the fruit completely provided that the bands were kept sticky and free from dust [*cf.* **16** 164]. Applying the banding material directly to the bark caused no injury where the trunk was shaded from direct sunlight. Digging 3 lb. crude naphthalene into the soil over an area four yards square round each tree in June did not reduce the emergence of weevils.

HAYWARD (K. J.). **El escarabajo o cascarudo rinoceronte** (*Strategus validus* **(Fabricius)**) **y la caña de azúcar.** [*S. validus* and Sugar-cane.]—*Circ. Estac. exp. agríc. Tucumán* no. 116, 3 pp., 3 figs., 3 refs. [Tucumán, 1943.]

Sugar-cane in the Argentine provinces of Salta and Jujuy and, more rarely, Tucumán, is injured by the adults of *Strategus validus*, F., which feed in the stems, the parts attacked being reduced to a mass of chewed fibres. This Dynastid has also been recorded from other parts of Argentina, and damages pineapple in the State of Goyaz, Brazil. The larvae live in decayed wood, particularly that in fallen forest trees, stacks of timber, etc., and the adults are likely to attack cane planted in recently cleared land or near forests where there are wood piles or fallen trunks.

GONÇALVES (L. I.). **O gorgulho japonês** *Callosobruchus chinensis* **(Linn., 1758) Pic. Observações sobre a sua biologia, hábitos, danos causados e meios de combate.** [*Bruchus chinensis*, L. Observations on its Biology and Habits, the Injury that it causes, and Measures of Control.]—*Publ. Div. Def. sanit. veg. Minist. Agric. Brasil* no. 14, 37 pp., 10 pls., 1 fldg. map, 11 refs. Rio de Janeiro, 1939. [Recd. 1943.]

Bruchus (*Callosobruchus*) *chinensis*, L., which is a cosmopolitan pest of leguminous seeds, both stored and in the field, has been found at two places in Brazil, one in the State of Rio Grande do Sul, where it attacked seeds of chick-pea

[*Cicer arietinum*] and white lupin [*Lupinus albus*], and the other in the Federal District of Rio de Janeiro. Both infestations were of small extent, but the Bruchid was thought to constitute a potential menace to Brazilian agriculture, as Japanese immigrants often carried infested seeds in their baggage. Its systematic status and distribution and the morphology of all stages are described, and an account is given of observations on its bionomics in the laboratory at Santos from October 1936 to October 1937, during which 12 generations were bred. The durations of development ranged from 37 days at an average temperature of 25°C. [77°F.] to 50 at one of 22·5°C. [72·5°F.] in winter and from 20 days at 30·5°C. [86·9°F.] to 29 at 27·5°C. [81·5°F.] in summer. Females survived for about 12 days, with a maximum of 18, and males for somewhat less. Carbon bisulphide, at the rate of 1 oz. per 5 cu. ft., killed all stages in seeds fumigated for 17 hours in a vacuum of 25 ins. In some samples of seeds from Japan, the predacious mite, *Pediculoides ventricosus*, Newp., had completely controlled the Bruchid. This mite is common in Brazil.

SMITH (M. R.). **The Relationship of Ants and other Organisms to certain Scale Insects on Coffee in Puerto Rico.**—*J. Agric. Univ. Puerto Rico* **26** no. 2 pp. 21–27, 1 ref. Rio Piedras, P.R., 1942.

The Coccids commonly found on coffee in Porto Rico are *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.), *Coccus viridis*, Green, *Cryptostigma inquilina*, Newst., *Pulvinaria psidii*, Mask., *Selenaspidus articulatus*, Morg., and *Ischnaspis longirostris*, Sign. The first two are the most numerous on coffee throughout the island and infest almost any part of the plant, but are usually most noticeable on the smaller twigs of the terminal branches and the base of the fruit. They become injurious, however, only under conditions particularly favourable for their development. Investigations in typical mountainous coffee-growing country between July 1935 and June 1936 showed that *Solenopsis geminata*, F., *Wasmannia auropunctata*, Roger, and *Brachymyrmex heeri* var. *obscurior*, Forel, were the commonest of the 14 species of ants that attend these two Coccids. Observations on the relation of *Solenopsis* and *Brachymyrmex* to *Saissetia coffeae* indicated that the ants showed little discrimination in soliciting honey-dew from individual Coccids that would be most likely to yield it, and that attendance by ants did not result in more frequent voiding of honey-dew and consequent increase of metabolism, but seemed to increase the quantity voided. Ants showed no evidence of special care or colonisation of the scale and had little if any effect in reducing parasitism by *Eucomys* (*Encyrtus*) *infelix*, Embleton. Few predacious insects were present, but no ants attacked the occasional ones observed. Entomogenous fungi, particularly *Cephalosporium lecanii*, seemed to be the principal factor regulating the abundance of *S. coffeae*, with the result that it is less numerous in cool, moist and shaded positions, where the fungi are favoured, than in exposed ones.

MCGREGOR (E. A.). **A new Spinning Mite attacking Sugar Cane in Puerto Rico.**—*J. Agric. Univ. Puerto Rico* **26** no. 4 pp. 91–92, 1 pl. Rio Piedras, P.R., 1942. (With a Summary in Spanish.)

Descriptions are given of the adults of both sexes of *Paratetranychus sacchari*, sp. n., from material collected in April 1939 on sugar-cane at Mayagüez, Porto Rico, where this mite is said to damage several varieties and to be increasing in importance. It was also found on sugar-cane, sorghum and a wild grass in other localities in the northern part of the island. *P. viridis*, Banks, has also been reported from sugar-cane in Porto Rico.

McLaine (L. S.). **The War Activities of the Federal Divisions of Entomology and Plant Protection since 1939.**—*73rd Rep. ent. Soc. Ont. 1942* pp. 7–16. Toronto, 1943.

This account of insect investigations and control activities in Canada relating more or less directly to the war is concerned chiefly with the protection of stored products, which is a serious problem, owing to the necessity for holding large quantities of foodstuffs for long periods, but also includes brief sections on insects attacking crops, forest trees, etc., and their biological control. In 1940, the Indian meal moth [*Plodia interpunctella*, Hb.] and species of *Ephestia*, which caused appreciable damage to the surface grain in a terminal elevator, were controlled by fumigation with hydrocyanic acid gas, followed by treatment with a proprietary fumigant (Weevilcide) to kill the larvae deeper in the bin ; a pyrethrum spray was used on the bin floor and round the ventilators and belts. During the winter of 1940–41, heavy outbreaks of grain mites occurred in temporary storages and were aggravated by failure to provide ventilation. It was found that they could be controlled by fumigation with chloropicrin injected a little below the surface of the grain at about half the rate recommended for the control of insects attacking stored products. More recently, grain cleaned before storing has become infested within six months by the rust-red grain beetle [*Tribolium castaneum*, Hbst.] and Psocids, the temperature of the grain being raised in some cases to about 100°F. Although the presence of moisture assists the development of high populations when they are established, they may often be found in grain containing about 12·5 per cent. moisture. Fumigation has given some control, but moving the grain has been necessary in some cases. Spider beetles [Ptinids], which are potentially serious pests of stored grain, have caused considerable losses in flour warehouses in western Canada, but as a result of control measures, these were less in 1942 than in 1941. To prevent the transport of grain pests in railway trucks, those that have carried grain known to be infested are thoroughly cleaned at the receiving terminal elevator by means of compressed air before being returned to the railway company.

Dried apples and dehydrated vegetables, the production of which has increased steadily since the beginning of 1941, are readily infested by insects, particularly *P. interpunctella*, and recommendations have been made for improved packing methods and particularly for replacing the wooden cases with open spaces between the boards, used for dried apples, by a carton with a sealed lid. The importance of treating imported foodstuffs, to prevent infestation from spreading to other materials in storage, and of disinfesting the ships and trucks used to transport them is emphasised, and methods of carrying out fumigation and other control measures are discussed.

Sheppard (R. W.). **The Japanese Beetle on the Niagara Frontier (a short History of Discovery and Captures, 1940–42).**—*73rd Rep. ent. Soc. Ont. 1942* pp. 20–24. Toronto, 1943.

An account is given of the collection of adults of the Japanese beetle [*Popillia japonica*, Newm.] in the Niagara Falls area of Ontario in 1940 and 1941 [*cf. R.A.E.*, A **31** 127] and in 1942. More than 1,600 traps were placed in the field at the eastern end of the Niagara peninsula from June 1942, and 372 beetles were collected between 11th July and 26th September.

Of 352 taken at Niagara Falls, 134 males and 178 females were collected on a natural embankment facing the river gorge, within a closed military zone, apparently indicating a recent extensive infiltration, not associated with artificial means of dissemination, and it is considered likely that, towards the end of August or beginning of September, a flight of considerable magnitude was caught in an upward current of air and carried across the river gorge to the embankment, where the beetles found favourable conditions and remained

to feed and mate throughout most of September. The temperature of this area differs markedly from that in surrounding territory ; the periodic drenchings by spray to which it is subject cause the atmosphere to be cool and damp in late spring and early summer and warm and damp from late summer until late autumn, and the vegetation is often covered with a heavy coating of ice from December to late March or early April. It is possible that these conditions may have a deleterious effect on the value of treatment against *P. japonica*. Only 15 beetles were taken on treated ground in Queen Victoria Park [*cf. loc. cit.*], and the remaining 25 on untreated ground in the park and at scattered points in the neighbourhood.

THOMPSON (R. W.). **The European Corn Borer Situation in Ontario in 1942.**— *73rd Rep. ent. Soc. Ont. 1942* pp. 24–26. Toronto, 1943.

Infestation of maize by the European corn borer [*Pyrausta nubilalis*, Hb.] was lower in 1942 than in 1941 throughout most of Ontario [*cf. R.A.E.*, A **31** 128]. In the area in which control regulations are in force, the population was lower, and although larvae were found singly in most of the infested maize stalks examined instead of in groups of 3–4 as in the previous year, the percentage infestation was lower in all but three counties. Commercial damage was less owing to less favourable weather, satisfactory disposal of maize refuse and the increased use of hybrids ; field maize was not injured to any significant extent. The average percentage of stalks infested in the different counties each year from 1926 to 1942 is shown in a table.

WISHART (G.). **Important Developments in the Corn Borer Parasite Situation.**— *73rd Rep. ent. Soc. Ont. 1942* pp. 26–30, 1 fig., 1 ref. Toronto, 1943.

Since the inception of attempts to introduce parasites of *Pyrausta nubilalis*, Hb., in Ontario, Quebec, New Brunswick and Nova Scotia in 1923, liberations have comprised more than four million adults of *Microbracon brevicornis*, Wesm., and *Ephialtes* (*Exeristes*) *roborator*, F., of which only a few recoveries of very doubtful value have been made, and about ¾ million of 15 other species and two additional races of parasites. Extensive liberations resulted in good initial recoveries of a few of these [*cf. R.A.E.*, A **22** 303], but the populations diminished rapidly and no evidence of natural increase of any species appeared until 1940, when *Lydella stabulans*, Mg. [the Tachinid also known as *Ceromasia senilis*, Mg.] was taken in south-western Ontario in all but one of the collections made along the shores of Lake St. Clair, the Detroit River and Lake Erie on 20th and 24th August, being most abundant in marshy districts, and *Eulophus viridulus*, Thoms., was recovered at two widely separated points in this area. These two parasites had not been liberated there since 1932 and 1931, respectively. Parasitism by the Tachinid was apparently lower in 1941 and 1942 in most cases, possibly owing to a considerable reduction in host population and to the impossibility of making extensive collections in sweet maize, in which parasitism is highest, but there was a remarkable extension in distribution of *Eulophus* with a considerable increase in the degree of attack at some points.

Observations indicated that *P. nubilalis* is developing a second generation annually in western Ontario and that the true multiple-generation strain from New England is well established in southern Quebec. Approximately 80 per cent. of the pupae of the overwintered generation of the latter were parasitised by the native Ichneumonid, *Labrorychus prismaticus*, Nort. [*cf.* **18** 118], possibly owing to the presence in the same area of *Tortrix cerasivorana*, Fitch, on which the parasite is reported to occur. The development of more than one generation of the borer per year may make the establishment of additional parasites possible, since some of these emerge too early to be present when the larvae of the strain with only one generation appear in the field.

ARNOTT (D. A.) & GOBLE (H. W.). **The Value of Molasses-free Baits in the Control of Cutworms in Tobacco Fields.**—*73rd Rep. ent. Soc. Ont. 1942* pp. 30–37, 6 refs. Toronto, 1943.

Tobacco growers in Ontario have controlled cutworms with a standard poison bait, composed of 25 lb. bran, 1 lb. Paris green, 1 quart molasses and 2½–3 gals. water, for many years, but wartime regulations restricted the distribution of molasses, and preliminary field tests were made in 1942 to determine whether it was a necessary ingredient of the bait, whether a lubricating oil could be used effectively in place of molasses and water, and whether carriers other than bran and poisons other than Paris green could be used. The baits were applied to typical tobacco fields infested with *Euxoa messoria*, Harr., and *E. detersa* var. *personata*, Morr., in one district, and these species and smaller numbers of *E. tessellata*, Harr., *Feltia ducens*, Wlk., and *Apamea* (*Crymodes*) *devastatrix*, Brace, in another, and their control values were estimated by the amount of plant injury or plant establishment occurring in the treated plots. Attempts were made to prepare, bait and plant the fields in accordance with the average practices in the district, but the season was unusually cool and wet, with the result that cutworms were sluggish and the tests were not made under normal conditions. The carriers tested included wheat bran, distillers' dried grains, sugar-beet pulp and a commercial stock food consisting largely of sugar-beet pulp, and the poisons were Paris green, sodium fluosilicate (at the same rate) and white arsenic and sodium arsenite (at rates that gave the same arsenic content in the bait). From the results obtained it is concluded that molasses probably does not add to the effectiveness of a bran bait, but may be of value in mixtures containing beet pulp or distillers' grains ; bran appears to be the most effective carrier ; the four poisons appear to be equally effective in bran and water mixtures ; and the addition of a light lubricating oil, with low sulphur content, as a wetting agent appears to be satisfactory when used with sodium arsenite or sodium fluosilicate in bran, but was of doubtful value when added to white arsenic or Paris green with either bran or distillers' grain. The use of a bran and water bait containing Paris green is therefore advisable until further investigations have been carried out.

HAMMOND (G. H.). **The White Grub Situation in Ontario during 1942 and a Forecast for 1943.**—*73rd Rep. ent. Soc. Ont. 1942* pp. 37–39. Toronto, 1943.

Second-year larvae of brood A of white grubs [*Lachnosterna* spp.] caused serious destruction of pasture, potatoes, cereals and garden crops over the greater part of Ontario in 1942 [*cf. R.A.E.*, A **31** 128], but the losses of maize were limited by the practice of planting it on land that had been under hoed crops rather than sod in 1941. This brood will not cause damage in 1943, and will not be at the most injurious stage again until 1945 and 1948 ; in the meantime, precautions such as planting lucerne to replace fibrous-rooted grasses may be taken.

There was little direct injury in localities infested with brood C, which was in the third-year stage. A large flight of adults was expected in these areas in May and June 1943, with serious defoliation of many forest, shade and ornamental trees.

GORHAM (R. P.). **The Potato Aphid Survey in the Maritime Provinces and eastern Quebec, 1942.**—*73rd Rep. ent. Soc. Ont. 1942* pp. 39–44. Toronto, 1943.

In 1942, field records for 76 potato farms in Quebec, 86 in New Brunswick and 69 in Prince Edward Island showed that Aphid infestation was greater in the first two provinces but less in the last than in 1941 [*cf. R.A.E.*, A **31** 129], and detailed analyses of four samples from each field showed that the observed

variation was caused chiefly by *Macrosiphum solanifolii*, Ashm., the most conspicuous species, which was present in 11 and 19 per cent. more of the samples from Quebec and New Brunswick and 22 per cent. less of those from Prince Edward Island. There is no direct experimental evidence that the nature of growth of potato plants has any influence on the rate of development and consequent prevalence of this Aphid, but there are some indications that climatic features that influence the growth of the plants affect the population on them. In July and August 1941, drought conditions prevailed in eastern Quebec and western New Brunswick, while rains were frequent and heavy in Prince Edward Island. In 1942, summer rainfall was almost normal in the first two areas, and Prince Edward Island had a prolonged spring and summer drought.

Myzus persicae, Sulz., was 10 and 5 per cent. less prevalent in collections from Quebec and Prince Edward Island, respectively, but showed little change in samples from New Brunswick, whereas *Aphis rhamni*, Boy. (*abbreviata*, Patch) showed 25 per cent. decrease in samples from Quebec and 10 and 24 per cent. increase in those from New Brunswick and Prince Edward Island, being generally most prevalent within two miles of its winter food-plants (*Rhamnus alnifolia* in New Brunswick and *R. cathartica* in Prince Edward Island). The average numbers of eggs per bud found on the winter food-plants were 6 in 1941 and 0·4 in 1942. *Macrosiphum solani*, Kalt. (*Myzus pseudosolani*, Theo.) was found generally in only a few samples from any province and showed little fluctuation in abundance ; its distribution appeared to be associated with that of its known winter food-plant, the garden foxglove [*Digitalis purpurea*], which is not extensively grown.

Aphid flight-traps gave definite evidence of the mass movements of alates of the three more abundant potato Aphids and afforded a means by which it was possible to obtain an estimate of the relative numbers of each species moving on a particular day.

ARMSTRONG (T.). **Notes on the Lesser Peach Borer, *Synanthedon pictipes* G. and R., in Ontario.**—*73rd Rep. ent. Soc. Ont. 1942* pp. 52–56, 1 pl., 1 graph, 6 refs. Toronto, 1943.

Aegeria (*Synanthedon*) *pictipes*, G. & R., is common on peach in Ontario, especially in badly cankered trees. Observations on its bionomics showed that the eggs were inserted in cracks of wounds and cankers on the trunk and branches, but not in portions that were wet and gummy, and hatched in an average of 11–12 days. The larvae bored into the bark tissue and fed on the inner bark, preferring the callus tissue about the margins of the wounded area and causing extensive injury until the weather became cold, when they ceased feeding and overwintered either well down in their tunnels or in hibernacula of silk and particles of frass. In spring, feeding continued until the larvae matured. Pupation occurred between early May and early August, in a cocoon of bark and silk constructed near the surface of the feeding area, and adults were present from late May until late August. Mating usually occurred on the day of emergence, and females that had not oviposited were found to contain 232–375 fully developed eggs. Males and females lived for averages of 9·3 and 8·8 days, respectively, in insectary cages and appeared to suck weak sugar solution or water, though no feeding was observed in the orchard. The life-cycle lasts not less than one year in the Niagara peach-growing area and may possibly extend over two in some cases.

When eggs were placed on branches free from wounds, on or under bark on artificially wounded areas, and on cankered areas, the average numbers of moths obtained per 100 eggs were 0, 1·5–3·9 and 5·4, respectively, indicating that, although the mortality of newly hatched larvae is extremely high in any case, for maximum survival they need shaded protected entrance areas where they require the least time to get beneath the bark surface to their food. It is

therefore advisable to keep the trees as free from implement wounds, cankers and winter injuries as possible. Cankers on the trunks and main branches of young trees should be cleaned thoroughly in May and June, disinfected with mercuric chloride (4 oz. per gal.) and covered with an asphalt preparation or paste of white lead and linseed oil, and the same treatment is also beneficial on older trees. Winter injury, in the form of bark splitting on the trunk, should be prevented by applying small quantities of nitrogenous fertiliser fairly frequently, rather than making heavy applications at longer intervals, and by carrying out cultivation and fertilisation in such a way as to ensure the proper maturing of the tree before cold weather. Painting infested areas in spring or summer with a solution of 8 oz. paradichlorobenzene in 1 quart cottonseed oil or 4 oz. in a 50 per cent. emulsion of lubricating spray oil or white oil failed to give effective control, and the solution in cottonseed oil injured some of the trees seriously when applied generously in spring.

Boyce (H. R.). **The Relation of some Apple Sprays to Codling Moth Parasitism by *Ascogaster quadridentatus* Wesm.**—*73rd Rep. ent. Soc. Ont. 1942* pp. 58–61, 4 refs. Toronto, 1943.

Examination of very large numbers of larvae of the codling moth [*Cydia pomonella*, L.] from burlap bands on the trunks of apple trees in the Niagara district, made in view of considerable variations in the percentage parasitism by *Ascogaster quadridentata*, Wesm. [*cf. R.A.E.*, A **30** 111], showed no consistent difference between sprayed and unsprayed orchards in 1939–41, but considerably higher parasitism in unsprayed orchards in 1942 [*cf.* **22** 402; **23** 317]. In laboratory tests, there was no essential difference in the length of life of adult parasites that were caged with apple seedlings sprayed with Bordeaux mixture (2 : 4 : 40) or 1½ lb. lead arsenate per 40 gals. or with cotton-wool soaked in the lead arsenate spray and others caged with unsprayed seedlings or cotton-wool soaked in water; but in a second series of tests, in which duplicate sets of female parasites were provided each day until they died with fresh sprayed and unsprayed apple foliage bearing eggs of *C. pomonella* one day old and also with sugar and water, sprays of 1 lb. lead arsenate, 1½ lb. lead arsenate with 1 gal. lime-sulphur, 1½ lb. lead arsenate and 4 lb. wettable sulphur with 1 gal. lime-sulphur, and 1½ lb. lead arsenate and 3 lb. Kolofog [bentonite sulphur], all in 40 gals., reduced oviposition, the percentages of eggs parasitised on leaves treated with these sprays and (in brackets) on the corresponding controls being 48·4 (69·6), 27·2 (75·9), 8 (45·4) and 43·7 (49·3), respectively. It is therefore concluded that the spray materials cause a physical or chemical inhibition of oviposition, possibly owing to the presence of particles on the host eggs or to masking of attractive emanations from them.

Monro (H. A. U.). **Tests with a Pyrethrum Aerosol against Cockroaches and Stored Product Pests.**—*73rd Rep. ent. Soc. Ont. 1942* pp. 61–63, 4 refs. Toronto, 1943.

The results are given of tests in Canada with a proprietary aerosol mixture stated to consist of pyrethrins, sesame oil and dichlorodifluoromethane (1 : 2 : 97), contained in a steel cylinder holding 5 lb. of the mixture and discharging 2 oz. per minute [*cf. R.A.E.*, A **31** 349], against *Blattella germanica*, L. [*cf.* B **31** 229] and pests of stored products. In elevator bins almost filled with wheat infested by *Plodia interpunctella*, Hb., so that only 500–1,000 cu. ft. of air space was left at the top, complete mortality of all the adults that were flying or fully exposed was given by dosages of 2, 4, 8 and 12 oz. per 1,000 cu. ft. Recently emerged adults, covered with web on the walls of the bins, were only partly controlled, and the highest dosage gave only 7 per cent.

control of larvae in webbing on the walls or near the surface of the grain, though, unlike the lower ones, it killed freely exposed larvae crawling in the bins.

In further experiments, the aerosol was discharged at the rate of 4 oz. per 1,000 cu. ft. into an empty airtight steel vault of 1,200 cu. ft. capacity through a small hole 6 ft. from the floor and 1 ft. from the roof. The period of exposure was six hours and the temperature 65°F. The test insects were unprotected mature larvae of *Tenebrio obscurus*, F., in jars and adults of *Tribolium castaneum*, Hbst., that were exposed in dishes or put in tins pierced with a hole $\frac{3}{4}$ in. in diameter that was covered with copper mesh (32 per in.) or steel mesh (80 per in.), some insects of each group being placed near the top and some on the bottom of the vault. The results were : complete mortality of fully exposed insects at the bottom of the vault, but no significant control of those near the top or those protected by mesh, when no fan was used ; complete mortality of all fully exposed insects, no significant kill of protected insects at the top and 59 and 100 per cent. kill of those protected by the 32 and 80 mesh, respectively, on the floor of the chamber, when a fan displacing 625 cu. ft. air per minute was run continuously during the test ; and mortality similar to that obtained with the fan when an initial vacuum of 20 ins. was provided and the aerosol was discharged into the chamber in the stream of air that entered when the hole in the side was opened.

It is concluded, therefore, that the mixture could be used at comparatively low concentrations at regular intervals to control moths flying in storages, to prevent their spread to other products in the building, but that it would not be effective at commercial dosages against insects protected by webbing or grain or those sheltered in cracks or crevices in the holds of ships or railway trucks.

PAQUET (G.). **Bioclimatic Study of the European Spruce Sawfly in Quebec.**— *Rev. canad. Biol.* **2** no. 2 pp. 149–167, 4 figs., 11 refs. Montreal, 1943; also as *Contrib. ent. Serv. Dep. Lds For. Quebec* no. 20, 20 pp.

An account is given of an investigation carried out in 1939 to ascertain the date of cocoon formation by the spruce sawfly, *Gilpinia hercyniae*, Htg., in various areas in Quebec in order to provide an index of their relative suitability for its development. Almost 75,000 larvae, representing 1,500 samples, were collected from a large number of localities over an area of 150,000 square miles between early June and mid-September and reared under uniform conditions in the laboratory. Over 20,000 cocoons were produced, and the dates on which they were formed were noted ; adults emerged before the winter from only 4·2 per cent. From these dates, the mean date of cocoon formation was estimated for each locality and for each of nine of the ten regions into which the Province was divided and which are shown on a map. The date of cocoon formation was also estimated by a method that is described from the number of larvae of each instar in the samples, which was used as an indication of the percentage of development completed at the locality at the time of sampling. The range of the mean observed date of cocoon formation for the nine regions was from 12th to 25th August and that of the mean calculated date was from 17th August to 1st September. There were some discrepancies in the order of suitability indicated by the two methods, but both indicated that the Eastern Townships and the Lower St. Lawrence regions were the most and the North Shore region the least favourable, the St. Maurice region and the Gaspé Peninsula occupying fourth and sixth places in the order of suitability. The mean dates of cocoon formation for each locality were determined from the observed and estimated dates and a bioclimatic map showing the areas in Quebec in which they are the same and developmental charts showing the differences between the mean dates for the different regions and for 31 localities are given.

Pickett (A. D.). **Recent Experiments in Insect Control in Nova Scotia.**—*79th Rep. N. S. Fr. Grow. Ass.* pp. 19–21, 23. Kentville, N.S., 1942.

Recommendations based on work in the Annapolis Valley in 1942 are given for sprays against insect pests of apple in Nova Scotia. Excellent control of the oystershell scale [*Lepidosaphes ulmi*, L.] was obtained from a 4 per cent. oil spray, and a 3 per cent. oil spray to which was added 20 oz. dinitro-ortho-cresol per 100 gals. also gave good results. The importance of spraying well within the dormant season in order to reduce the risk of serious damage to the trees is stressed; where this was done, no injury resulted from a spray containing 5 per cent. oil and three times the recommended amount of dinitro-o-cresol. It is thought that *L. ulmi* may decrease in importance, as it was less vigorous in most orchards than it had been in the previous year and appeared to be dying out in neglected orchards. Damage by the eye-spotted budmoth [*Spilonota ocellana*, Schiff.] increased in many orchards, though in others there was a decrease. Sprays containing dinitro compounds give only moderate control and do not justify their cost unless they are required against other pests. Neither lead arsenate nor calcium arsenate, both of which are effective against the grey-banded leaf-roller [*Eulia mariana*, Fern.], proved of value in late summer sprays against *S. ocellana*, but nicotine sulphate and fixed nicotine were very satisfactory. Dormant sprays containing 5 per cent. oil or 2½ per cent. oil with 12 oz. dinitro-o-cresol per 100 gals. appeared equally effective against the green apple bug [*Neolygus communis novascotiensis*, Knight], the apple red bug [*Lygidea mendax*, Reut.] and the mullein leaf bug [*Campylomma verbasci*, H.-S.], none of which was numerous during the season. The rosy apple aphis [*Anuraphis roseus*, Baker], which was more injurious than for some years, was apparently controlled by the addition of 8 oz. dinitro-ortho-cresol per 100 gals. to the oil emulsion used in the dormant stage. The same material applied without oil in the dormant and green-tip stages gave promising results, but it scorched the buds severely and did not afford adequate control when applied at the delayed dormant stage. Except where a combined treatment against *Lepidosaphes ulmi* and *A. roseus* is required, the use of nicotine sulphate during the delayed dormant stage is recommended against the latter.

Damage by the codling moth [*Cydia pomonella*, L.] in the Annapolis Valley was the most widespread ever recorded, and this is attributed to the long, warm season, which enabled a partial second generation to develop. In orchards in which injury was serious, however, the initial larval populations surviving from the previous year were large. In investigations on plots in an otherwise unsprayed orchard, some control was obtained from all sprays applied from the pink-bud stage onwards; although made more than a month before the larvae hatched, the pink-bud application gave marked control. Where infestation is severe, this and all subsequent sprays should contain an arsenical. After the petal-fall application, sprays were applied at intervals of approximately 10 days until 1st August, and the control obtained improved after each.

Steiner (L. F.). **Control of the Codling Moth under present Conditions.**—*Trans. Ill. hort. Soc. 1942* **76** pp. 243–252. Quincy, Ill., 1943.

The author points out that a risk of a shortage of insecticides or spraying equipment increases the importance of supplementary measures for the control of the codling moth [*Cydia pomonella*, L.] on apple, and makes suggestions based on experiments carried out at Vincennes, Indiana, during the last eight years. They include precautions against the overwintering larvae, which occur chiefly in packing or storage houses, on trees that have borne fruit in the previous summer and on the ground under these trees. Moths generally emerge in sheds two weeks or more later than in the orchard, and escape through cracks, windows, doors and ventilators. Most sheds can be sealed cheaply with scrap

timber and tobacco cloth, and if the shed is being used, a light-trap near the door will trap many moths that might escape when the door was opened. Larvae that spin their cocoons on trees usually do so under rough bark and many can be destroyed by scraping it and burning the scrapings. If, however, even a few wound cavities or broken branches are present, sometimes 10 ft. or more above ground, 50 per cent. of the larvae may conceal their cocoons in these, where they are better protected from birds and low temperatures. Moths from such cocoons generally emerge late in the spring, thus extending the period of attack by the first generation. Broken branches should be removed annually, and cavities probed, screened or filled.

Chemically treated bands may be used to reduce the current and following seasons' population ; an increase of 50 per cent. or more in the numbers of larvae caught has been obtained by banding the main branches as well as the trunk without preliminary scraping of the bark. When the ground is very clean, it may be free from larvae, but under other conditions, more than 60 per cent. of the orchard population may be in ground débris, which should therefore be removed. About half the ground population is generally within five feet of the trunk ; preferred natural quarters on the ground, in order of their importance, are wood, weed stems, leaves and mummied apples, provided they are in well-drained situations, but boxes, baskets and pieces of burlap may be even more attractive.

Where immigration of moths from neighbouring orchards is likely [*cf. R.A.E.*, A **29** 193], spraying must be relied on for protection. In any case, pruning should be carried out to reduce excessive height or bushiness of the trees, in order to reduce the quantity of spray necessary, and the prunings should be burnt before emergence begins. When the fruit sets in clusters, thinning will prevent entries between the apples ; all injured apples should be removed and destroyed when thinning. Frequent removal of dropped apples after the middle of August, when many larvae are still present, helps to reduce the number of overwintering larvae.

The value of different spray schedules is discussed. Both lead arsenate and nicotine bentonite are more effective if supplemented with oil and if not mixed with fungicides. Nicotine bentonite is less affected by weather conditions than lead arsenate, which is more toxic and gives better control in cool or rainy seasons than under hot, dry conditions, and compares with it most favourably in the southern areas or where seasons are hot and dry. It causes less fruit or foliage injury, results in heavier crops and larger fruits with better colour and finish and fewer superficial injuries, and gives good control of leafhoppers, but is more expensive, cannot be used with a fungicide late in the season and will not completely prevent late attack in the calyx regions of varieties of large size or having deep calyx cavities unless the spray is directed up into the cavity. The apples have to be washed if lead arsenate or tank-mix nicotine bentonite and soy-bean oil, the most effective and least expensive nicotine-bentonite combination, is used, but not if factory-processed materials or mineral oil and nicotine sulphate are substituted for the latter from late July. Split schedules of lead arsenate in the early sprays and nicotine bentonite in the later ones may be necessary where the plum curculio [*Conotrachelus nenuphar*, Hbst.] is injurious, but in Indiana, residues of lead arsenate from early cover sprays have consistently reduced the toxicity of nicotine deposits applied two months later, so that the combination may be less effective than either material used throughout the season.

" Top-off " sprays are important, since more eggs are laid in the tops of the trees, particularly by migrating moths, and less spray material adheres there ; also, what does adhere weathers off more rapidly than from the lower parts of the trees, where some of the weathered material is redeposited. The use of the top-off calyx spray and at least one application near the peak of first-generation hatch is recommended, with additional ones in a rainy season or when insecticides

that weather off rapidly are used and to the outer six or eight rows of the orchard where the trees are subject to infestation from outside. A sudden increase in the number of larval entries is sometimes caused by a change in weather, a flight of moths into the orchard or some other factor. If a lead-arsenate schedule is being used, immediate and thorough application of a spray of lead arsenate and nicotine sulphate, with a mineral oil unless it is later than 1st July, will kill many larvae that have been in the fruit for three days or less. If a nicotine programme is being used, a thorough application of the regular formula will kill many of these larvae, but the most effective treatment against them is mineral oil and nicotine sulphate. Where different varieties of apple adjoin, the harvesting of one variety when moths are abundant will increase oviposition on the remaining one, and in this case a cover spray applied within five days is often helpful in checking a concentrated attack.

Comparative tests with more than 15,000 newly hatched larvae from each of two similarly situated orchards in the Ohio and lower Wabash valleys showed considerable differences in their ability to enter sprayed fruit. Those from one orchard, which had been sprayed heavily with lead arsenate during the five years since 1936, entered fruit sprayed with lead arsenate, nicotine bentonite, cryolite or xanthone in significantly greater numbers than those from the other, which had not been sprayed since 1936. The two orchards received similar treatment before that date. No difference was found in the ability to enter fruit sprayed with phenothiazine or that left unsprayed or in the resistance of eggs to xanthone, micronised nicotine bentonite, mineral oil or mineral oil and nicotine. In the laboratory, nicotine was more effective than lead arsenate against the strain from the sprayed orchard and less effective than lead arsenate against the other strain.

ANNAND (P. N.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, 19**[41–]**42.**—60 pp. Washington, D.C., U.S. Dep. Agric., 1942.

An account is given of work on insect pests and their control in the United States during the year ended June 1942, some of which has already been noticed. Micronised phenothiazine was again as effective as lead arsenate against the codling moth [*Cydia pomonella*, L.] on apple in field tests in several localities, but standard phenothiazine was less satisfactory ; in some cases both types, particularly the former, had an adverse effect on the colour or on the size and rate of ripening of the fruit [*cf. R.A.E.*, A **31** 354]. Xanthone was less effective than lead arsenate in the Middle West and the eastern States, while in Washington, where the extent of total injury on apples sprayed with it and with lead arsenate was about equal, it allowed more larvae to establish themselves in the fruit. No further marked increase in the area infested by *Parlatoria chinensis*, Marl., was found near St. Louis, Missouri, after the autumn of 1941 [*cf.* **31** 250]. In studies on its control on fruit trees, sprays of 2–3 per cent. summer oil or 4 per cent. dormant oil gave high mortality of all stages. The only deleterious effect on the trees of increasing the concentration of mineral oil (viscosity approximately 200 Saybolt), applied against the pear psylla [*Psylla pyricola*, Först.] in the Pacific Northwest, from 3–4 to 10 per cent. was a temporary retardation of development in spring ; surveys showed that this Psyllid was present in northern Oregon and western Washington. New infestations of Comstock's mealybug [*Pseudococcus comstocki*, Kuw.] were found in Connecticut and New Jersey. Five of the parasites imported against this mealybug from Japan [**30** 589, 593 ; **31** 308] have been colonised in 24 orchards in Virginia, West Virginia, Ohio, Georgia and Connecticut, and one of the species of *Allotropa* (referred to as No. 1) survived the winter at several points in the first three States and increased in a number of orchards. Adults of *Macrocentrus ancylivorus*, Rohw., for liberation against the oriental fruit moth [*C. molesta*, Busck] on

peach were reared in a cage enclosing 0·1 acre of strawberry plants infested with the strawberry leaf-roller [*Ancylis comptana*, Froel.] at the rate of 630,000 parasites per acre [*cf.* **30** 590]. In a preliminary experiment in which bait traps supplemented mass liberations of parasites, injury to the fruit was considerably lower than in orchards in which traps were not employed.

In large-scale experiments to develop substitutes for lead arsenate against the grape-berry moth [*Polychrosis viteana*, Clem.] in the Lake Erie vine belt, a programme of arsenicals followed by processed nicotine bentonite [*cf.* **31** 394] was more effective than one of nicotine bentonite only. Micronised phenothiazine gave highly effective control and was more satisfactory than the standard type. A hooded spray boom facilitated spraying in fairly windy weather. The yield of pecan trees sprayed against the pecan nut case-bearer [*Acrobasis caryae*, Grote] in Texas with a mixture of lead arsenate, nicotine sulphate and summer oil was 2–3 times that from trees sprayed with lead arsenate alone. A high proportion of the crop in some orchards in the central part of the State is destroyed by the pecan weevil [*Curculio caryae*, Horn]. In experiments against pests of dried fruit, exposure to a temperature of 32°F. killed adults of the saw-toothed grain beetle [*Oryzaephilus surinamensis*, L.] and fully grown larvae of the Indian meal moth [*Plodia interpunctella*, Hb.] in 22 and 23 days, but some fully grown larvae of the raisin moth [*Ephestia figulilella*, Gregson] were still alive after 125 days; at 36°F., the first two insects died in 33 and 47 days, but 26 per cent. of the larvae of the third survived an exposure of 130 days.

Infestation by the western pine beetle [*Dendroctonus brevicomis*, Lec.] on ponderosa pine [*Pinus ponderosa*] in Oregon, Washington and California was less marked in 1941 than in previous years, and direct control measures were required only in recreational areas in southern and central California. A limited survey in a part of western North Carolina where infestation by termites is moderate indicated that, under such conditions, poured concrete piers or concrete caps on masonry piers are unnecessary in buildings without basements provided that there is no skirting and that ample clearance and ventilation is provided. In studies on insecticides to replace lead arsenate against the gipsy moth [*Lymantria dispar*, L.], pyrethrum proved very toxic to the small larvae, and cryolite and some compounds of dinitro-o-cyclohexylphenol to larvae of all sizes. Injection into the trunks of elm trees of a mixture of sodium chlorate, or sodium bisulphite, and sodium arsenite at the rate of 10 gm. and $\frac{1}{4}$ gm., respectively, per inch of the diameter at breast height made the trees attractive to the bark-beetles that transmit Dutch elm disease [*Ceratostomella ulmi*] and poisonous to the beetles and their offspring. Adults of the chief vector, *Scolytus multistriatus*, Marsh., attracted to such trap trees can be caught and cultured to determine whether the fungus is present. A spray of fuel oil with monochloronaphthalene (10 : 1 by volume) was as effective against elm bark-beetles as one of fuel oil and orthodichlorobenzene (4 : 1). The white pine weevil [*Pissodes strobi*, Peck] is the most important of the insect pests of pine plantations in the Lake States [*cf.* **31** 344], but Cercopids, at least two species of sawflies and the pine chafer [*Anomala oblivia*, Horn] are also injurious.

Infestation of winter wheat by the Hessian fly [*Mayetiola destructor*, Say] at harvest was heavy in western Kentucky, south-western Missouri, south-eastern Nebraska and eastern Kansas, and moderate to heavy in Illinois, Indiana and eastern Pennsylvania. At least 50 of a total of 3,000 varieties of wheat were highly resistant to attack and were used in the development of hybrids with high resistance to *M. destructor* and to one or more fungous diseases. No evidence was obtained that races of the fly able to attack resistant varieties might develop if these were the only ones available.

Protracted drought reduced populations of the European corn borer [*Pyrausta nubilalis*, Hb.] in the eastern States and in the Lake States, with the exception of western and south-western Indiana and north-western Illinois, where there was

an increase. More than 66,000 parasites were liberated against it during the year; *Lydella stabulans* var. *grisescens*, R.-D. [the Tachinid also known as *Ceromasia senilis*, Mg.], which has dispersed and increased rapidly since its liberation in New Jersey, was present over an area of 300 sq. miles.

Cool, rainy weather in spring and early summer restricted the area infested by grasshoppers in 1941, especially in the eastern Great Plains; in the western Great Plains, the weather was favourable and populations were moderate to large. The lesser migratory grasshopper [*Melanoplus mexicanus*, Sauss.] produced a partial second generation in western Kansas and neighbouring areas in 1941. Sodium fluosilicate was found to be preferable to sodium arsenite in grasshopper baits, since it is readily available and distasteful to live-stock, and a waste industrial product containing 60 per cent. sodium fluosilicate and 30 per cent. calcium fluoride proved satisfactory as a substitute for commercial sodium fluosilicate. A bait in which the water was replaced by a smaller volume of lubricating oil [**30** 591] was almost as effective against the Mormon cricket [*Anabrus simplex*, Hald.] as the standard one in large-scale tests in Oregon and northern Nevada; this bait, in addition to eliminating the need for transporting large volumes of water in dry areas, is suitable for application by aircraft, and keeps well in storage. Mortality was not affected when the concentration of sodium fluosilicate was reduced from 4 to 3 lb. per 100 lb. bran, but the effect was slower [**30** 62].

Good control of the vetch Bruchid [*Bruchus brachialis*, Fhs.], which continued to spread in western Oregon and south-western Washington, was given in field tests by a dust containing rotenone and sulphur. As investigations on the legume weevil [*Hypera brunneipennis*, Boh.] in the Yuma area of Arizona confirmed previous findings that it cannot breed extensively on lucerne and prefers relatively unimportant plants, such as sour clover [*Melilotus indica*], and populations in experimental plots of lucerne were almost eradicated by timely cutting, studies on the weevil were discontinued. The higher mortality of white grubs [*Lachnosterna*] in sweet clover [*Melilotus*] than in blue-grass [*Poa*] was found to be due to the small root-system and greater quantity of water extracted from the soil by the former, rather than to its unsuitability as food. Larvae of white-fringed beetles [species of the subgenus *Graphognathus* of *Pantomorus*] were much more resistant to arsenical soil insecticides than those of *Popillia japonica* or May-beetles [*Lachnosterna*]; 2,000 lb. calcium arsenate per acre (which seriously injured the vegetation) did not give complete mortality, whereas 1,000 lb. per acre was effective against the Lamellicorns. In experiments on cultural measures of control, cowpeas and soy beans were more seriously damaged by the weevil larvae than ground-nuts or cotton, and fine-rooted crops, such as Bermuda grass [*Cynodon dactylon*], provided very unfavourable conditions. Tests during 1938–40 indicated that populations in infested fields that are allowed to lie fallow for one year are reduced by an average of 98·8 per cent. In laboratory tests, *Neoaplectana glaseri*, Steiner, which parasitises *P. japonica*, and an undescribed Nematode of the same genus that is endemic at Gulfport, Mississippi, caused 32–100 and 77–100 per cent. mortality, respectively, of *Pantomorus* within 29 days.

Box-cars used in the railway transport of heavily-infested grain in the Central States during the moist summer of 1941 themselves became infested; fumigation with methyl bromide at 2 lb. per 1,000 cu. ft. space for 24 hours was effective in the case of steel box-cars loaded with flour, but not in wooden ones. Well-made and carefully sealed paper sacks gave excellent protection from most insect pests to flour stored for four months in infested warehouses, but are easily damaged in handling. Dusts of cryolite alone or diluted with 20 per cent. inert carrier gave 98 99·5 per cent. mortality of the sugar-cane borer [*Diatraea saccharalis*, F.] when applied four times at weekly intervals against young first-generation larvae in 1941, and was also satisfactory under commercial conditions over 800 acres in the early summer of 1942.

Work on the various mole-crickets that are injurious to vegetables in Florida showed that the southern mole-cricket [*Scapteriscus acletus*, Rehn & Heb.] is less susceptible than the changa [*S. vicinus*, Scud.] to the calcium arsenate bait in general use and that sodium fluosilicate is effective against both species. Wheat bran was the most satisfactory of the commonly available carriers in baits, and meat scrap was the only material that showed promise as an added attractant. Derris combined with Bordeaux mixture and insoluble copper sprays and dusts reduced the numbers of Aphids on potato in Maine, increased the yield and decreased the incidence of certain virus diseases, but the control of leaf-roll [*Corium solani* of Holmes] was not satisfactory. It was found that Aphids that infest potatoes breed on at least eight weeds that occur commonly in potato-growing districts in northern Maine [*cf.* **31** 251]. Calcium arsenate dust was the most effective of the materials tested against potato flea-beetles [*Epitrix*] in field tests in the Pacific North-west ; dusts containing zinc arsenite and certain fluorine and rotenone compounds gave fairly good control after eight applications. In field-tests against *Lygus* spp. on sugar-beet grown for seed in Arizona and Oregon, a dust consisting of an impregnated pyrethrum powder, sulphur and pyrophyllite, applied when the adults and nymphs were abundant on the seed-stalks, gave effective control. In Arizona, plants that became infested by the beet leafhopper [*Eutettix tenellus*, Baker] when the seed-stalks averaged 2 ins. in length suffered much more from curly-top [*Chlorogenus eutetticola* of Holmes] than those infested when the average length was 15 ins. It is therefore important to employ cultural methods that hasten the development of seed-stalks before the immigration of leafhoppers.

Cryolite and lead-arsenate sprays controlled tobacco hornworms [*Protoparce*] on plants for flue-cured tobacco in South Carolina, 3–5 applications being necessary on early and mid-season crops and 5–6 on late ones, but cryolite sprays were of no value against these Sphingids on tobacco of the dark fire-cured or burley type in Tennessee or on shade-grown tobacco in Florida. Paper linings in the ordinary hogsheads in which tobacco is stored gave a high degree of protection against the cigarette beetle [*Lasioderma serricorne*, F.] and the tobacco moth [*Ephestia elutella*, Hb.] in Virginia, and damage by these insects was also prevented by storing tobacco at 60–65°F.

Insecticides containing arsenic applied to cotton as the eggs of the bollworm [*Heliothis armigera*, Hb.] are hatching are fairly effective against the young larvae before they enter the bolls and squares, but not against the older ones. In tests of dusts for the combined control of *Heliothis* and the boll weevil [*Anthonomus grandis*, Boh.] in Texas, the yields of seed cotton per acre were 1,530 lb. for basic copper arsenate, 1,393 lb. for zinc-safened calcium arsenate, 1,216 lb. for calcium arsenate and 781 lb. for no treatment. Basic copper arsenate was more toxic to the larger larvae of *Heliothis* than any other material in cage tests and was also effective against the weevil and the cotton fleahopper [*Psallus seriatus*, Reut.]. Injury by *Heliothis* is intensified by the increased Aphid populations that follow the use of arsenicals, since the honey-dew of the Aphids attracts the ovipositing moths, and they provide an alternative prey for predators that would otherwise feed upon the eggs and young larvae ; furthermore, arsenicals kill the predators themselves. Approximately 1,200 examples of the Anthocorid, *Paratriphleps laeviusculus*, Champ., which is predacious on *H. armigera*, were imported from Peru and released in Texas. In the lower Rio Grande Valley, larvae of the pink bollworm [*Platyedra gossypiella*, Saund.] in cages survived from September until May in open, dry bolls on the surface of the soil. Larvae developed in green cotton in every month except February and March and were found in the green and dry pods of okra [*Hibiscus esculentus*] during autumn and winter ; one was observed on *Malvaviscus drummondi* [*cf.* **30** 428]. No larvae were found hibernating in cocoons in the soil, as they do in drier areas. The use of early-maturing varieties of cotton and improved cultural practices reduces

the overwintering populations in the Big Bend area of Texas by permitting earlier harvest and clean-up operations.

Parasites imported into the United States during the year included *Microbracon vestiticida*, Vier., against *Anthonomus grandis* and *A. eugenii*, Cano, and *Triaspis vestiticida*, Vier., against *A. grandis*, both from Peru, and *Ephialtes* (*Calliephialtes*) *dimorphus*, Cushm., and *Microbracon* sp. from Brazil against *P. gossypiella*. A method of rearing *M. vestiticida* on the bean Bruchid [*Bruchus obtectus*, Say] was developed [**31** 401], and 1,767 adults were produced for liberation. A consignment of *Acaulona peruviana*, Tns., and *Hyalomyia chilensis*, Macq., both parasites of cotton stainers [*Dysdercus*], was shipped from Peru to Porto Rico, where puparia of *Theresia claripalpis*, Wulp (*diatraeae*, Brèth.) and *Metagonistylum minense*, Tns., and adults and cocoons of *Iprobracon* spp. were also received from South America for liberation against *Diatraea saccharalis*. The importation into the United States from Brazil of *Lydinolydella metallica*, Tns., a parasite of *Epilachna* spp., was continued [**30** 593], and on the completion of the rearing of *Triaspis thoracicus*, Curt., a consignment of adults was sent to California for liberation against the broad-bean Bruchid [*Bruchus rufimanus*, Boh.]. Larvae of *Pseudaphycus* sp. and *Anagyrus* sp. were imported from Japan against *Pseudococcus comstocki* in 1941 ; emergence of *Allotropa* sp. from material imported from Japan earlier in the year [**30** 593] was completed and 28,042 adults were sent to Connecticut for release. Parasites and predators shipped to other countries comprised *Scutellista cyanea*, Motsch., against the black scale [*Saissetia oleae*, Bern.], *Rodolia cardinalis*, Muls., against the cottony-cushion scale [*Icerya purchasi*, Mask.], *Prospaltella berlesei*, How., against the white peach scale [*Aulacaspis pentagona*, Targ.], and *Aphelinus mali*, Hald., against the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] in Bolivia ; *Microbracon mellitor*, Say, against *Anthonomus grandis* in Haiti ; *Cryptolaemus montrouzieri*, Muls., against mealybugs in Mexico ; *Metagonistylum minense* against *Diatraea saccharalis* in Cuba ; *Coccophagus* spp. against the soft scale [*Coccus hesperidum*, L.] in Canada ; *T. thoracicus* against Bruchids in Canada and Australia ; and *Prospaltella perniciosi*, Tower, to Canada for transmission to South Africa against the San José scale [*Aspidiotus perniciosus*, Comst.].

The mortality among adult parasites of Coccids was frequently found to be high following the use of insecticidal and inert dusts, those with the finest particles being the most toxic. Serious interference with the control of mealybugs on *Citrus* by *Cryptolaemus montrouzieri* followed the use of sulphur and cryolite dusts, and sulphur sprays and dusts caused a marked reduction in the parasitism of the eggs of the white apple leafhopper [*Typhlocyba pomaria*, McAtee] by *Anagrus*. Lime-sulphur sprays containing oil or lead arsenate did not injure Coccinellids preying on the European red mite [*Paratetranychus pilosus*, C. & F.] on apple. Chemical investigations on insecticides are briefly reviewed.

Service and Regulatory Announcements, January-March 1943.—*S.R.A., B.E.P.Q.* no. 154 pp. 1–14. Washington, D.C., U.S. Dep. Agric., 1943.

Recent work in the United States has shown that fumigation of plants in pots or soil balls with methyl bromide under partial vacuum is effective against the various stages of the white-fringed beetles [species of the subgenus *Graphognathus* of *Pantomorus*] at a series of dosage schedules modified according to the temperature of the soil balls, and that *P. peregrinus*, Buchanan, is slightly more resistant than the other species. Administrative Instructions (*B.E.P.Q.* 503 fourth revision supplement no. 1 first revision), in an Announcement relating to Quarantine no. 72 against these beetles, therefore authorise vacuum fumigation with methyl bromide at rates of 5½, 4½, 4, 3½, 3 and 2½ lb. per 1,000 cu. ft. at 50, 55, 60, 65, 70 and 75°F., respectively, against species other than *P. peregrinus*,

and at 5½, 5, 4½, 4, 3½ and 3 lb. respectively, when this species is present. No change is made in the authorised method of fumigation [*R.A.E.*, A **29** 568] or size of the soil balls or pots [**31** 116].

Schwitzgebel (R. B.) & Wilbur (D. A.). **Lepidoptera, Hemiptera and Homoptera associated with Ironweed, *Vernonia interior* Small in Kansas.**—*Trans. Kans. Acad. Sci.* **45** pp. 195-202, 6 refs. Lawrence, Kans., 1942. **Diptera associated with Ironweed, *Vernonia interior* Small in Kansas.**—*J. Kans. ent. Soc.* **16** no. 1 pp. 4–13, 8 figs., 6 refs. Manhattan, Kans., 1943.

These papers are the second and third of a series on insects associated with ironweed (*Vernonia interior*) in grassland in Kansas [*cf. R.A.E.*, A **31** 391. The Diptera included 5 species of Trypetids from the flowers, and 22 species of Hymenopterous parasites were reared from them, some of which are also parasites of crop pests. They included *Apanteles epinotiae*, Vier., *Elasmus setosiscutellatus*, Crwf., and *Eupelmus allyni*, French, and *E. allyni* was also one of 11 Hymenopterous parasites bred from the Cecidomyiid, *Lasioptera vernoniae*, Beut., which was found in more than 50 per cent. of the stems.

Altstatt (G. E.) & Smith (H. P.). **Production, Diseases and Insects of Garlic in Texas.** *Circ. Tex. agric. Exp. Sta.* no. 93, 13 pp., 7 figs., 1 ref. College Station, Tex., 1942.

This circular includes a short section on the Arthropods that attack garlic in Texas. *Thrips tabaci*, Lind., is the most important and causes serious damage under certain conditions; no satisfactory control measures are available. In heavy soil, the larvae of *Lachnosterna* (*Phyllophaga*) *farcta*, Lec., which has a life-cycle lasting two years, often kill young plants and make holes in mature bulbs, rendering them unfit for sale. A reduction of injury may be obtained by a proper crop rotation; cotton or oats may be planted, but maize, potatoes and other vegetable crops should not be grown on infested soil. The larvae of *Ceuthorrhynchus tau*, Lec., feed on the young leaves of both garlic and onion when the plants are about 3–5 months old, often destroying several of the central leaves and killing the plants. The injury is sometimes severe in new fields, but observations during the past five years indicate that the numbers of weevils and the damage caused increase with each successive crop on the same land. Rotations excluding onions, the use of different fields each season and the removal of weeds from the cropping area are advised. The bulb mite, *Eriophyes tulipae*, Keifer, is common on stored garlic [*cf. R.A.E.*, A **30** 603] and when present in large numbers may cause numerous blemishes on the cloves, which are not evident until these are separated and peeled. No control measures are known.

Christian (M. B.). ***Lyctus* Beetle Damage Prevention. Second Report on chemical Dip Tests against *Lyctus* Powder-post Beetles, *Lyctus parallelopipedus* (Melsh.) and *Lyctus planicollis* Leconte.**—*Sth. Lumberm.* 15th June 1940, repr. 2 pp., 3 figs. Nashville, Tenn., 1940. **Biology of the Powder-post Beetles, *Lyctus planicollis* Leconte and *Lyctus parallelopipedus* (Melsh.).**—*Louisiana Conserv. Rev.* **9** no. 4 pp. 56–59, **10** no. 1 pp. 40–42, 12 figs., 19 refs. New Orleans, La., 1940–41. [Recd. 1943.]

A summary of the information in the first of these papers has already been noticed [*R.A.E.*, A **29** 447–448]. The second comprises detailed accounts of investigations carried out in Lousiana in 1938–40 on the bionomics of *Lyctus parallelipipedus*, Melsh., and *L. planicollis*, Lec., which appear to be the most common species of the genus in the United States and were reared in large numbers from wood collected in mill yards in Louisiana, Mississippi and Arkansas.

The eggs are laid in the surface wood pores, at depths of 1–3 and 4–7·5 mm., respectively, and hatched in 6–15 days. Larvae of *L. parallelipipedus* may mature in 60 days under ideal conditions, but those of *L. planicollis* require longer, usually 4–9 months. Pupation takes place about $\frac{1}{8}$ in. below the surface of the wood, and the pupal stage lasts 12–21 days. The adults emerge through circular holes, 1 and rather less than 2 mm. in diameter, respectively, and mate and begin to oviposit soon after, each female depositing about 25 fertile eggs. The beetles live about 3–4 weeks and are most active at night, the smaller species, *L. parallelipipedus*, being much the more active. They feed on the surface wood, but consume very little.

L. parallelipipedus may have two generations a year in newly seasoned woods of high starch content. In tests in which adults of this species were caged with pieces of ash sapwood, large numbers of the next generation emerged after only three months from wood containing much starch and smaller numbers after 11 months from that containing only a small amount. Life-cycles of only three months were also observed in oak and pecan. The general spring flight period of this species from timber in Louisiana yards is from mid-April to the end of June ; a second generation appeared in late summer and the beetles continued to emerge until the cold weather in autumn. The life-cycle of *L. planicollis* generally lasts a year, though under favourable conditions a few beetles matured and emerged in 4–5 months ; adults were found in mill yards only in spring and early summer, the majority emerging from about 15th March to 15th May in Louisiana.

In laboratory experiments with wood samples kept at specific moisture contents and subjected to attack by newly emerged beetles, larvae developed in all samples containing 6–32 per cent. moisture ; adults oviposited in wood containing 65 per cent., and development would have occurred if the wood sample had been allowed to dry under mill-yard conditions. Adults of *L. parallelipipedus* were found in large numbers on timber that had been converted from green logs only two weeks before, and, in several instances, emerged from timber in the mill yard that had been converted only 4–5 months earlier. It is therefore necessary to treat the timber while green to prevent the initial infestation, as it is impossible to keep the moisture content of the wood below 6 per cent. in the Gulf States unless some moisture-repellent material is impregnated in the kiln-dried wood. It was found that some sapwood of ash, hickory and oak did not contain sufficient starch for the development of *Lyctus* larvae and that the adults oviposited only in timber containing starch, if this was available. Investigations on the starch content of freshly cut logs of these trees, however, indicated that with the possible exception of oak, most of them contain enough starch for the development of *Lyctus*.

Two predacious Clerids, *Tarsostenus univittatus*, Rossi, and *Monophylla terminata*, Say, and four parasites, *Monolexis lycti*, Cress., *Sclerodermus macrogaster*, Ashm., and undescribed species of *Heterospilus* and *Ecphylus*, were taken from infested wood during the study. Of these, *T. univittatus* and *M. lycti* were most common, and *Heterospilus* was often found emerging in large numbers from wood infested with *L. parallelipipedus*. The eggs of *T. univittatus* were laid in the vessels of wood infested by *Lyctus*, and the larvae located the tunnels of the *Lyctus* larvae and fed on them ; the adults devour those of *Lyctus*. The life-cycle probably lasts a year. In tests in which uninfested newly seasoned red oak sapwood with a high starch content was caged for four months with ten adults of either species of *Lyctus*, with or without five adults of the Clerid, no infestation was found in the cages containing the latter, but attack was severe in the others, indicating that where present in sufficient numbers, the adults can effectively prevent *Lyctus* attack. Since, however, the Clerid is dependent on *Lyctus* stages for food necessary for reproduction, a large predator population is probably impossible without an abundance of *Lyctus*, and under outside conditions the Clerid adults do not appear so early in spring as some of those of

L. planicollis. When small pieces of ash wood that had been infested by this species under cage conditions, but showed no external indications of attack, were caged with adult females of *M. lycti*, pieces that were split open showed a *Lyctus* larva directly below the surface at each point where the parasite's ovipositor had penetrated the wood. Other pieces that were removed from the parasites after 24 hours and kept at 80°F. gave rise to 31 parasites in rather more than a month, some appearing after only 25 days. Apparently only one egg is laid on each *Lyctus* larva, and the parasite larva crawls over the body of the host and feeds through the epidermis. In most of the wood infested under field conditions by *L. parallelipipedus*, the emergence holes of parasites greatly outnumbered those of *Lyctus*; parasitism is probably higher in the smaller species because of its shorter life-cycle, which enables the parasite to build up a greater population.

RUSSELL (L. M.). **An apparently new Species of *Paurocephala* Crawford (Homoptera, Psyllidae, Pauropsyllinae).**—*Proc. ent. Soc. Wash.* **45** no. 5 pp. 115–120, 12 figs. Washington, D.C., 1943.

Descriptions are given of all stages of the Psyllid, *Paurocephala gossypii*, sp. n., which causes severe damage to cotton (*Gossypium* sp.) in the southern cotton belt of the Belgian Congo.

HEINRICH (C.). **A preoccupied Name in Tortricidae (Lepidoptera).**—*Proc. ent. Soc. Wash.* **45** no. 5 p. 126. Washington, D.C., 1943.

The author points out that the generic name *Peronea*, Curtis, is preoccupied in Mollusca and that the next available name for this genus is *Acleris*, of which the type is *A. aspersana*, Hb.

MCGREGOR (E. A.). **A new Spider Mite on Citrus in southern California (Acarina : Tetranychidae).**—*Proc. ent. Soc. Wash.* **45** no. 5 pp. 127–129, 8 figs. Washington, D.C., 1943.

Tetranychus lewisi, sp. n., is described from adults of both sexes taken on the fruits of navel orange in California, where it was also collected from lemon fruits. It was reared at temperatures of 62–73°F. on young lemon leaves to which females from oranges were transferred. The females began to oviposit within 24 hours of becoming adult and laid about five eggs a day. The incubation period lasted six days and the larval and two nymphal instars of the females each occupied two days. The males pass through only one nymphal instar, and their development therefore lasts a day or two less than that of the females. The mites form and shelter under a loose web; their feeding causes a stippled appearance on both leaves and fruit, due to the extraction of pigment.

HENDERSON (C. F.) & MCBURNIE (H. V.). **Sampling Technique for determining Populations of the Citrus Red Mite and its Predators.**—*Circ. U.S. Dep. Agric.* no. 671, 11 pp., 6 figs., 1 ref. Washington, D.C., 1943.

The authors describe a method of estimating populations of *Paratetranychus citri*, McG., and its predators on *Citrus*, developed in order to study the effect of chemical control practices on the natural enemies of the mite in the United States. An electrically operated apparatus was devised in which the mites and eggs were brushed from the leaves or fruits on to a glass disk coated with newly applied varnish or other adhesive; they were later counted by means of a counting mask that exposed a number of areas amounting in all to about 25 per cent. of the surface of the disk. It was found that an average of about 82 per cent. of the eggs on foliage and fruit, 88·3 per cent. of the mites on foliage and 86 per cent. of those on fruit were counted by this technique. No satisfactory method

was found for keeping the mites in their original condition for a week, but when they were placed in a refrigerator at about 40°F. and examined within three or four days, no difficulty was found in differentiating mites that were alive at the time of taking the collections from those that were dead.

To estimate field populations of mites and predators, 12 leaves were removed at random from each of 10–15 trees in each plot or grove. The number of predators on each leaf was recorded immediately after its removal from the tree, and the leaves were brushed when the entire sample had been collected. Single-leaf samples are not practicable, since a varnished disk has to be provided for each sample, but either surface of a leaf could be sampled by this method if necessary by covering the other with a piece of paper. The analysis of single-leaf samples taken from a number of trees showed that, under the conditions encountered, taking more than 12 leaves per tree would give very little reduction in the sampling error, increasing the number of trees being more advantageous if greater accuracy was desired. The variation between subsamples from individual trees was the lowest source of error, which indicated that the disturbance to the mite population resulting from successive collecting was small and also that the results of the collecting and brushing technique could readily be reproduced.

Papers noticed by Title only.

Bodine (J. H.) & Robbie (W. A.). **Physiological Characteristics of the Diapause Grasshopper Egg** [*Melanoplus differentialis*, Thos.]. **II. Changes in Density and Weight During Development.**—*Physiol. Zool.* **16** no. 3 pp. 279–287, 4 figs., 9 refs. Chicago, Ill., 1943. [*Cf. R.A.E.*, A **29** 328.]

Ram Mohan Rao (S.). **A Note on the Discovery** [in Coimbatore] **of apterous Males in the pink Mealy-bug of Sugarcane,** *Trionymus sacchari* **Ckll. (Coccidae Homoptera).**—*Curr. Sci.* **12** no. 7 p. 208, 1 fig., 2 refs. Bangalore, 1943.

Smit (B.). **The Control of Household Insects in South Africa.**—*Bull. Dep. Agric. For. S. Afr.* no. 192 (2nd edn.) 42 pp., 1 col. pl., 18 figs., 14 refs. Pretoria, 1943. Price 6*d*. [*Cf. R.A.E.*, A **28** 78.]

Twinn (C. R.). **A Summary of the more important Crop Pests in Canada in 1942.**—*73rd Rep. ent. Soc. Ont. 1942* pp. 64–70. Toronto, 1943.

Friend (R. B.) & Zappe (M. P.). **Laws and Regulations concerning the Inspection of Nurseries in Connecticut and Transportation of Nursery Stock.**—*Circ. Conn. agric. Exp. Sta.* no. 151 pp. 17–57. New Haven, Conn., 1942. [Revision of Circ. 141 : see *R.A.E.*, A **28** 439.]

Law, Rules, Regulations and Quarantines pertaining to the Certification and Transportation of Nursery Stock and other Plants [in Kansas].—*Circ. Kans. ent. Comm.* no. 4, 22 pp. Topeka, Kans., 1943.

Price (W. C.). **Severity of Curly Top** [*Chlorogenus eutetticol* of Holmes] **in Tobacco affected by Site of Inoculation** [by *Eutettix tenellus*, Baker].—*Phytopathology* **33** no. 7 pp. 586–601, 1 fig., 21 refs. Lancaster, Pa., 1943. [For abstract see *R.A.E.*, A **31** 275.]

Hoskins (W. M.). **Recent Contributions of Insect Physiology to Insect Toxicology and Control.** [A discussion of the literature.]—*Hilgardia* **13** no. 6 pp. 307–386, 15 pp. refs. Berkeley, Calif., 1940. [Recd. 1943.]

Bartholomew (E. T.), Sinclair (W. B.) & Lindgren (D. L.). **Measurements on Hydrocyanic Acid absorbed by** *Citrus* **Tissues during Fumigation.**—*Hilgardia* **14** no. 7 pp. 373–409, 9 graphs, 13 refs. Berkeley, Calif., 1942.

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